

H 84801

**Field and Laboratory Data
on Some
Podzol, Brown Podzolic, Brown Forest,
and Gray Wooded Soils
in Northern United States
and Southern Canada**

**Soil Survey Laboratory Memorandum No. 1
Beltsville, Maryland
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UNITED STATES DEPARTMENT OF AGRICULTURE
In cooperation with the
**AGRICULTURAL EXPERIMENT STATIONS
OF CONNECTICUT, IDAHO, MONTANA, MINNESOTA,
WASHINGTON, AND WISCONSIN
AND
THE EXPERIMENTAL FARMS SERVICE,
DOMINION DEPARTMENT OF AGRICULTURE, CANADA**

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This memorandum was prepared by the Divisions of Soil Survey and Soil Management and Irrigation Agriculture, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture.

INTRODUCTION

The natural system of soil classification is being subjected to intensive review by soil scientists in this and other countries. Since a large number of scientists can make useful contributions to a satisfactory interpretation, it seems desirable to reproduce many of the data in advance of interpretation so that they may be studied widely while the research program goes forward. The larger is the number of competent soil scientists contributing to interpretations and redefinitions of groups, the better will be the results to be expected.

Some time ago soil scientists generally recognized the need for much clearer distinctions in definition among soils in the Podzol, Brown Podzolic, Brown Forest, and Gray Wooded groups. Definitions of these groups are of course closely related to definitions of the adjoining great soil groups, such as Gray Brown Podzolic, and the associated azonal and intrazonal soils. Basically we need to improve our understanding of the morphological and genetic relationships among these soils. Several soil scientists in Canada, in the United States Department of Agriculture, and in the State agricultural experiment stations have important responsibilities in this work. Several new studies have been published in recent years, including the current year. Besides those included in these publications, other data have been obtained in the field that have not been published, data that may be very useful to many soil students. Of course additional data are needed, and those already available need to be used. It does not appear that anyone is yet in a position to develop definitive conclusions. It is thought that the data in this pamphlet may be useful to many people able to contribute to an understanding of the problem through study in advance of a new interpretation. Thus this pamphlet is intended wholly as a working tool for soil scientists concerned with these groups of soils.

It is clear from the table of contents that representative soils were examined in several parts of northern United States and southern Canada. Some of the gaps are already covered, in recent literature, at least partially, and other gaps remain to be filled by further research.

As indicated on the title page and throughout the pamphlet, many individuals from several agencies have contributed toward the field and laboratory work.

As implied above, the material is presented for students of soils without discussion or interpretation because it seems to many that detailed interpretation at this moment might be premature. It is hoped that many can assist in the interpretation even though they haven't had an opportunity to take part in the research itself.

Sites for soil sampling were carefully selected by field scientists familiar with the local soil types represented, their geographical distribution, and their associations with other soils. It will be noted that duplicate soil profiles have usually been taken, although it has not been possible up to the present to get proper duplicates of all of them. Perhaps it should be noted that the soil textural class names given in the horizon descriptions are those assigned by the field morphologists and do not necessarily agree with the results obtained in the laboratory.

Standard laboratory methods were used as follows:

Mechanical analyses were made by the pipette method according to Kilmer and Alexander.¹ Exchangeable cations were determined after extraction with neutral normal ammonium acetate solution. The macromethods described by Peech *et al*² were used at the University of Minnesota in determining calcium, magnesium, sodium, and potassium. The same methods were used in the Bureau except that sodium and potassium were determined with the flame

¹Kilmer, Victor J. and Alexander, Lyle T. 1949 Methods of making mechanical analyses of soils. Soil Science 68: 15-24.

²Peech, M. *et al*. 1947 Methods of soil analysis for soil fertility investigations. U. S. Dept. Agric. Cir. 757.

photometer.³ Exchangeable hydrogen was determined on a separate sample by the triethanol-amine method. pH was measured with a glass electrode in a 1:1 water-soil suspension. Organic carbon was determined by the dichromate reduction method.²

The following abbreviations were used in the tables:

S + = sum of cations.

% B. Sat. = percent base saturation.

% o. c. = percent organic carbon.

Mechanical analysis

Clay: less than 0.002 mm.

Ill: 0.02 - 0.002 mm. (International silt)

USDA silt: 0.05 - 0.002 mm.

VFS: 0.1 - 0.05 mm., very fine sand.

FS: 0.25 - 0.1 mm., fine sand.

MS: 0.5 - 0.25 mm., medium sand.

CS: 1 - 0.5 mm., coarse sand.

VCS: 2 - 1 mm., very coarse sand.

Individual references in the descriptions give the names of the field morphologists. Mechanical analyses, pH, and organic carbon determinations are by B. J. Epstein, C. B. Scott, and S. M. Spillman. Exchangeable cation determinations for profiles 7 to 34 and 37 to 68 are by R. S. Clarke, Jr., F. D. Davol, and E. M. Roller. Exchangeable cation determinations for profiles 1 to 6 and 35 and 36 are by the Soils Department, University of Minnesota. The data were compiled by J. K. Ableiter and V. J. Kilmer, Bureau of Plant Industry, Soils, and Agricultural Engineering.

²Peech, M. et al. 1947 Methods of soil analysis for soil fertility investigations. U. S. Dept. Agric. Cir. 757.

³Barnes, R. B., et al. 1945 Flame Photometry. Indus. and Engin. Chem. Analyt. Ed. 17: 605-611.

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Clallam fine sandy loam	Clallam Co., Wash.	60
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No Series Name at Present Time:		
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Nebish silt loam

Otter Tail County, Minnesota, north of Underwood. SE 1/4 SE 1/4 Sec. 28, Twp. 135N, R 41W. Samples taken by Prof. P. R. McMiller and I. J. Nygard on Oct. 5, 1948.

<u>Field No.</u>	<u>Inches</u>	<u>Horizon</u>	<u>Description</u>
33970	3-0	A ₀	10YR 2/2 very dark brown leaf and root mat, moderately decomposed. Neutral.
	0-1/2	A ₁	10YR 4/2, dark grayish brown, to 5/2 grayish brown silt loam; fine granular structure, high in organic matter. This horizon was not sampled.
33971	1/2-5	A ₂	10YR 7/2, light gray, coarse silt loam; moderately developed fine platy structure; vesicular; very friable; roots numerous; pebbles few; neutral.
	5-7	A ₃	2.5Y 8/2, white, to 8/4 pale yellow silt loam; weakly developed platy structure, grading downward to fine nut-like structure; few roots. This layer is more compact than layer above. Not sampled.
33973	7-12	B ₂₁	10YR 4/2, dark grayish brown silty clay loam; crushes to 10YR 5/8 yellowish brown. Well developed blocky structure; aggregates firm, coated with light gray and dark brown; few pebbles; roots numerous; very slightly acid.
33974	12-18	B ₂₂	10YR 4/3, brown silty clay loam; very well developed coarse blocky structure. The blocks crush with much pressure to 10YR 6/4, light yellowish brown. Few pebbles, some limonite; few roots; very slightly acid. This layer is weakly prismatic in place.
33975	18-29	B ₃	10YR 4/4 dark yellowish brown, light silty clay loam. Weakly developed very coarse irregular platy structure. The aggregate is streaked with 7.5YR 3/2 dark brown, and specked with a few iron stains; slightly calcareous, the calcareous portion being pale yellow. Few pebbles of dolomitic and granitic origin, and a few shale fragments. This layer is more compact than layer above.
33976	29-44	C _c	2.5Y 6/4 light yellowish brown, streaked with 8/2 white, clay loam; friable; calcareous; numerous pebbles, many dolomitic; few iron stains (7.5YR 5/8, dark brown). Lime segregation is web-like, or not net-like, and nearly white.
33977	44-54	C ₂	2.5Y 7/4 pale yellow, streaked with 8/2 white, clay loam; friable; highly calcareous. This layer is similar to layer above but less streaked with lime.

Samples were taken in an undisturbed area on a slope of 3-4%. The topography in general was strongly morainic, but the morainic ridges where sampled were less steep and lower. Vegetation was sugar maple, basswood, oak, aspen, other poplars such as balm of Gilead, and elm.

Otter Tail County, Minnesota

(Gray Wooded)

Nebish silt loam

S48Minn56-3-1 to 3-8

Lab. Nos. 49644 to 650

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
3-0	A ₀	--	--	--	--	--	--	--	6.8	--	--	--	--	--	--	--	--	--
1/2-5	A ₂	2.8	0.8	<0.1	<0.1	0.7	4.3	84	7.3	0.30	4.2	15.7	30.2	13.7	27.0	12.6	9.3	3.0
7-12	B ₂₁	13.3	4.7	0.4	<0.1	2.5	20.9	88	6.8	0.33	28.3	11.8	21.2	9.6	19.8	9.2	7.9	4.0
12-18	B ₂₂	11.8	4.3	0.2	<0.1	2.5	18.8	87	7.0	0.31	23.4	13.3	24.0	9.6	20.5	9.8	8.7	4.0
18-29	B ₃	--	--	--	--	--	--	--	8.0	0.23	15.4	15.9	28.5	11.8	22.8	10.3	8.2	3.0
29-44	C _c	--	--	--	--	--	--	--	8.1	0.14	16.7	17.5	29.7	10.6	21.5	9.9	8.8	2.8
44-54	C ₂	21.0	3.1	<0.1	<0.1	0.0	24.1	100	8.2	0.02	14.2	13.9	27.8	12.7	23.5	10.4	8.3	3.1

Nebish silt loam

NW Otter Tail County, north of Pelican Rapids, NE 1/4 NE 1/4 Sec. 15, Twp. 137 N, R. 42W. Samples collected by Prof. P. R. McMiller and I. J. Nygard on October 5, 1948.

<u>Field No.</u>	<u>Inches</u>	<u>Horizon</u>	<u>Description</u>
33978	2-0	A ₀	10YR 2/2, very dark brown leaf and root mat; neutral. This layer may be referred to as Mor.
33979	0-5	A ₂	10YR 8/2 white silt loam; well developed fine platy structure; slightly vesicular; very friable; rocks abundant; no pebbles neutral to slightly alkaline.
33980	5-10	B ₂₁	10YR 4/2, dark grayish brown silty clay loam; well developed medium blocky structure, the blocks coated with 10YR 7/2 light gray, and crush with very great pressure to 10YR 6/4, light yellowish brown. Roots numerous; no pebbles; neutral.
33981	10-15	B ₂₂	10YR 4/2, dark grayish brown, and 3/2 very dark grayish brown silty clay loam. Strongly developed, very coarse blocky structure; the blocks are coated with light gray but less than in the layer above, and are also slightly coated with organic stains; crushes to 10YR 6/4, light yellowish brown. Roots less numerous than in layer above; few pebbles; neutral.
33982	15-23	B ₃	10YR 6/4, light yellowish brown sandy clay loam; weakly developed, very coarse blocky structure; crushes to 2.5Y 7/4, pale yellow; neutral.
33983	23-29	C ₀₁	2.5Y 7/4 pale yellow streaked with white, sandy clay loam; massive; highly calcareous; few pebbles, largely dolomitic; few roots; few reddish brown iron stains.
33984	29-45	C ₀₂	2.5Y 7/4, very pale yellow streaked with white and slightly mottled with strong brown sandy clay loam; massive; highly calcareous; many pebbles, largely dolomitic; lime segregation moderate; few roots; few iron stains.
33985	45-55	C ₂	2.5Y 7/4, pale yellow clay loam; massive; highly calcareous; rather compact but friable when removed; Mankato till; lime segregations in streaks.

Samples taken along a fresh road cut underneath a forest cover of mixed deciduous trees. Main tree species are oak, largely red oak, poplar (aspen, balm of Gilead), a few box elders and basswood, with an undercover of hazel brush.

Otter Tail County, Minnesota

Nebish silt loam

Lab. Nos. 49651 to 658

to 4-8

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O. C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
2-0	A ₀	--	--	--	--	--	--	--	6.6	--	--	--	--	--	--	--	--	--
0-5	A ₂	6.2	1.4	0.2	0.0	1.1	8.9	88	7.4	0.47	9.0	27.8	52.8	12.1	12.9	6.5	5.4	1.3
5-10	B ₂₁	13.8	3.6	0.5	<0.1	2.6	20.5	87	7.1	0.38	29.2	30.1	54.0	7.6	4.8	2.1	1.8	0.5
10-15	B ₂₂	13.5	4.2	0.4	<0.1	2.6	20.7	87	7.0	0.30	29.5	20.1	35.5	7.9	12.2	6.7	6.2	2.0
15-23	B ₃	--	--	--	--	--	--	--	7.0	0.23	13.4	7.8	16.4	11.0	23.7	13.4	14.8	7.3
23-29	C ₀₁	--	--	--	--	--	--	--	7.8	0.10	8.8	8.0	18.1	12.5	25.5	14.1	14.5	6.5
29-45	C ₀₂	17.4	2.0	<0.1	<0.1	0.0	19.4	100	8.2	0.14	9.4	9.2	20.2	12.6	25.1	13.9	13.7	5.1
45-55	C ₂	--	--	--	--	--	--	--	8.1	0.08	11.3	10.1	20.4	12.1	24.5	13.5	13.1	5.1

Taylor silt loam

Beltrami County, east of Buena Vista. SW 1/4 Sec. 36, Twp. 149N R. 33W. Samples collected by Prof. P. R. McMiller and I. J. Nygard on October 6, 1948.

<u>Field No.</u>	<u>Inches</u>	<u>Horizon</u>	<u>Description</u>
33993	2-0	A ₀	10YR 2/2, very dark brown leaf and root mat; neutral.
33993A	0-1	A ₁	10YR 5/2, gray brown silt loam; moderately developed fine granular structure. This layer is impregnated with fibrous roots.
33994	1-12	A ₂	10YR 8/2, white very fine sandy loam; moderately developed platy structure; vesicular, compact in place but very friable when removed; few roots; few brown stains; very slightly acid; slightly cemented when dry.
33995	12-16	B ₂₁	10YR 4/2, dark grayish brown coated with 8/2 white, heavy silty clay loam. Well developed medium blocky structure, grading downward to coarse blocky. The blocks are coated on the outside with silt-size particles generally white in color, which have been infiltrated from horizon above by filling in of cracks. These blocks crush with extreme pressure to 10YR 4/4, dark yellowish brown. Few granitic pebbles; few roots; very slightly acid.
33996	16-25	B ₂₂	10YR 4/2, dark gray brown mottled with 4/4 dark yellowish brown and 5/6 yellowish brown, silty clay. Strongly developed coarse blocky structure. The blocks are very firm and very stable. Some are coated with white silty material extending as tongues from above. Few pebbles, largely of granitic origin; very slightly acid.
33997	25-35	B ₃	10YR 4/3, dark brown silty clay, strongly developed coarse blocky structure; crushes under great pressure to 10YR 5/6 yellowish brown. Few pebbles; occasional roots; very slightly acid.
33998	35-46	C ₂	2.5Y 5/4, light olive brown silty clay loam; massive; few pebbles; calcareous; few reddish brown and dark red stains.

Samples were taken from a pit under a thick stand of forest of mixed hardwoods on a 2-3% slope about 150 feet south of a drop of 20 to 30 feet into a valley. Surface drainage is good. Vegetation, hard maple predominates. Other trees are aspen, balsam of Gilead, elm and white birch. Intermingled among these hardwoods are a few trees of balsam fir and white spruce. The ground cover is almost absent, consisting largely of Lycopodium (ground pine) and poison ivy.

Beltrami County, Minnesota

Taylor silt loam

S48Minn-4-1-1 to 107

Lab. Nos. 24659 to 665

Depth Inches	Horizon	M.E./100 Grams Soil						%B. SAT	pH	% O.C.	Size Classes %						
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS
2-0	A ₀	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--
0-1	A ₁	--	--	--	--	--	--	--	5.7	5.1	5.5	16.1	30.8	17.2	34.1	6.7	4.1
1-12	A ₂	2.3	0.5	<0.1	<0.1	1.4	4.2	67	6.6	0.26	3.3	9.2	22.5	25.0	36.3	6.5	4.4
12-16	B ₂₁	6.7	2.2	0.2	<0.1	2.7	11.8	77	6.4	0.20	16.7	13.1	24.5	16.8	27.6	7.5	4.8
16-25	B ₂₂	9.9	3.6	0.4	<0.1	4.2	18.1	77	6.1	0.19	26.7	14.9	25.8	14.0	21.6	6.2	4.2
25-35	B ₃	--	--	--	--	--	--	--	5.6	0.16	26.8	14.0	25.1	13.5	21.8	6.4	4.6
35-46	C ₂	14.2	6.1	0.2	<0.1	1.1	21.6	95	7.0	0.23	22.5	17.7	30.9	13.8	20.1	6.0	4.6

Beltrami silt loam

Beltrami County, NE 1/4 NE 1/4 Sec. 34, Twp. 150N, R. 32W. Samples collected by Prof. P. R. McMiller and I. J. Nygard on October 7, 1948.

<u>Field No.</u>	<u>Inches</u>	<u>Horizon</u>	<u>Description</u>
33999	3-0	A ₀	10YR 2/2, very dark brown, spongy Mor; neutral; charcoal present.
34000	0-3	A ₂	10YR 8/2 and 8/1, white silt loam; well developed fine platy structure; vesicular; very friable; aggregate spotted with 10YR 7/4, very pale brown; few roots; neutral.
34001	3-7	A ₃	10YR 6/2, light brownish gray silt loam, moderately developed fine platy structure. The aggregate is slightly mottled with 10YR 6/3, pale brown, and 6/6, brownish yellow. Friable; few small pebbles; few roots; neutral.
34002	7-12	B ₂₁	10YR 5/2, gray brown silty clay loam; well developed fine platy structure. The aggregates are moderately coated with white silt, are firm and slightly mottled with 10YR 5/6, yellowish brown. Few roots; few granitic pebbles; neutral.
34003	12-23	B ₂₂	10YR 4/2, very dark grayish brown specked with 6/6 brownish yellow and 6/4 light yellowish brown silty clay. Strongly developed medium blocky structure. Aggregates are very firm and slightly coated with white silt; roots fairly numerous; few tiny pebbles of mixed origin; calcareous; mildly alkaline.
34004	23-32	B ₃	Highly mottled 2.5Y 7/2 light gray, and 7/6 yellow; light silty clay loam; massive; calcareous; friable; few pebbles; few roots; few old root channels.
34005	32-38	C _c	Highly mottled 2.5Y 7/2 light gray and 6/4, light yellowish brown, and 7/6 yellow, heavy silt loam; highly calcareous; massive; many darkened old root channels. Lime segregation occurs as a white net-work. Few pebbles; few roots; material crushes to 2.5Y 6/4, light yellowish brown.
34006	42-52	C ₂	2.5Y 7/4 pale yellow highly calcareous heavy silt loam till, specked and spotted with 2.5Y 8/2 white and 4/4 olive brown.

These samples were taken from a pit dug under a heavy stand of mixed deciduous trees, aspen and balm of Gilead predominate, with elm, oak, white birch, ash and ironwood. Intermingled are several younger trees of white cedar, white spruce, and balsam fir. 1-2% slope.

Beltrami County, Minnesota

Beltrami silt loam

Lab. Nos. 49666 to 673

S48Minn-4-2-1 to 2-8

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
3-0	A ₀	--	--	--	--	--	--	--	6.6	--	--	--	--	--	--	--	--	--
0-3	A ₂	4.0	1.4	<0.1	<0.1	2.1	7.5	72	6.4	0.48	8.4	40.8	63.2	14.7	8.6	2.2	1.9	1.0
3-7	A ₃	6.5	2.9	<0.1	<0.1	2.8	12.2	77	6.2	0.27	14.8	28.8	48.2	18.4	11.2	2.9	2.9	1.6
7-12	B ₂₁	14.4	6.8	0.3	<0.1	3.0	24.5	87	6.6	0.37	28.7	35.8	50.0	9.8	7.0	1.9	1.8	0.8
12-23	B ₂₂	16.3	7.6	0.2	<0.1	3.6	27.7	87	6.5	0.36	36.4	44.8	54.2	3.9	3.4	1.0	0.8	0.3
23-32	B ₃	--	--	--	--	--	--	--	7.4	0.18	15.5	65.1	83.1	0.6	0.5	0.2	0.1	0.0
32-38	C _c	--	--	--	--	--	--	--	7.6	0.14	28.6	59.9	68.4	1.2	1.2	0.3	0.2	0.1
42-52	C ₂	19.6	3.2	<0.1	<0.1	0.0	22.8	100	7.8	0.16	12.5	63.2	83.8	1.4	1.4	0.4	0.3	0.2

Beltrami silt loam

NE 1/4 NE 1/4, Section 3, Twp. 149N, R. 31W, Beltrami County. Samples collected by Prof. P. R. McMiller and I. J. Nygard on October 7, 1948.

<u>Field No.</u>	<u>Inches</u>	<u>Horizon</u>	<u>Description</u>
34013	2-0	A ₀	10YR 2/2 very dark brown spongy Mor; charcoal and fungi Mycelium present; very slightly acid.
34014	0-6	A ₂	10YR 8/2 white very fine sandy loam. Well developed fine blocky structure; slightly vesicular; roots abundant; pebbles few; slightly acid.
34015	6-14	B ₂₁	10YR 4/3, dark brown, coated with 8/2 white, silty clay loam. Strongly developed medium blocky structure. The blocks crush with difficulty to 10YR 6/4; light yellowish brown. Few pebbles; many roots; infiltration of white silt from above very noticeable. Slightly acid.
34016	14-22	B ₂₂	10YR 3/2, very dark brown, heavy silty clay loam. Strongly developed medium blocky structure, the blocks more heavily coated than in layer above. Blocks firm and crush to 10YR 5/4, yellowish brown. Very slightly acid.
34017	22-31	C ₁₁	2.5Y 7/4 pale yellow, and 6/4 light yellowish brown light silty clay loam. Sub-angular medium blocky structure; calcareous; friable; many old root channels; few dolomitic and granitic pebbles.
34018	31-37	C ₁₂	2.5Y 8/4, pale yellow, light silty clay loam; massive; highly calcareous; very friable; many pebbles, largely dolomitic; few iron stains; few roots.
34019	37-47	C ₂	2.5Y 8/4, pale yellow silt loam. Lime segregated into a web-like net. Moderately compact but very friable when disturbed. Many pebbles.

These samples were taken from a rather fresh cut along a recently widened secondary road underneath a stand of aspen and balsam of Gilead in which are interspersed a few white spruce. Samples taken on a low ridge of 4-5% slope.

Beltrami silt loam

Beltrami County, Minnesota

Profile #5
(Gray Wooded)

S48Minn-4-3-1 to 3-7

Lab. Nos. 49674 to 680

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
2-0	A ₀	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--	--
0-6	A ₂	2.4	1.0	<0.1	<0.1	3.9	7.3	46	5.8	0.32	9.2	19.6	34.6	17.4	23.4	7.0	5.0	3.4
6-14	B ₂₁	8.8	3.9	0.2	<0.1	5.3	18.2	71	5.7	0.26	27.3	15.8	27.4	14.3	18.8	5.6	4.5	2.1
14-22	B ₂₂	10.3	4.6	0.2	<0.1	4.1	19.2	79	5.6	0.25	27.6	14.2	26.2	14.3	19.4	5.8	4.6	2.1
22-31	C ₁₁	--	--	--	--	--	--	--	7.4	0.27	20.3	22.6	38.2	13.9	16.7	4.7	4.2	2.0
31-37	C ₁₂	21.2	3.1	<0.1	<0.1	0.0	24.3	100	7.7	0.14	18.3	24.8	40.6	13.1	16.1	5.0	4.6	2.3
37-47	C ₂	21.2	2.9	<0.1	<0.1	0.0	24.1	100	7.8	0.24	16.6	20.4	38.6	11.4	20.4	5.7	4.9	2.4

Taylor silt loam

Itasca County, east of Blackduck, NW 1/4 of NW 1/4, Sec. 15, Twp. 149N, R. 29W
 Samples collected by Prof. P. R. McMiller and I. J. Nygard on October 7, 1948.

<u>Field No.</u>	<u>Inches</u>	<u>Horizon</u>	<u>Description</u>
34007	3-0	A ₀	10YR 4/2, dark grayish-brown spongy Mor. At the lower part of this layer is a very thin layer, about 1/8" thick, of charcoal and silt loam high in organic matter. Sample not taken of this lower layer. Very slightly acid.
34008	0-2 1/2	A ₂	10YR 8/1, white silt loam, slightly mottled with 6/2 light brownish gray. Moderately developed fine platy structure; vesicular; very friable; roots numerous; few dark colored pebbles; slightly acid.
34009	2 1/2-6	B ₁	10YR 8/1, white, and 6/2, light brownish gray silty clay loam. Fine to medium blocky structure, the blocks firm and crush to 10YR 7/2, light gray; few roots; few dark colored pebbles; very slightly acid.
34010	6-19	B ₂	10YR 4/2, dark grayish brown silty clay, Strongly developed coarse blocky structure; blocks are very firm and crush to 10YR 5/4, yellowish brown; few roots; few pebbles; neutral. The structure is slightly prismatic in place.
34011	19-31	B ₃	10YR 6/2, light brownish gray mottled with 2.5Y 7/4, pale yellow, silty clay loam. Well developed coarse blocky structure; blocks crush with difficulty to 2.5Y 6/4, light yellowish brown. Calcareous; many pebbles, largely dolomitic; few old root channels. The structure is weakly prismatic in place.
34012	31-39	C ₂	2.5Y 7/2, light gray, and 6/6 yellow, silty clay loam; crushes to 2.5Y 8/4, pale yellow; calcareous; many dark and old root channels, occasional live roots; many pebbles, largely dolomitic. This layer is more friable than layer above.

Samples were taken from a freshly dug pit underneath a heavy cover of mixed deciduous forest, aspen and balsam of Gilead predominating. Other trees are white birch, ash, oak, mountain maple, and a few balsam fir and white spruce. Lower cover consists largely of a few hazel and willow shrubs, with meadow rue and large leaf aster. 2% slope.

Itasca County, Minnesota

Taylor silt loam

Lab. Nos. 49681 to 686

S48Min-31-1-1

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
3-0	A ₀	--	--	--	--	--	--	--	6.3	--	--	--	--	--	--	--	--	--
0-2 1/2	A ₂	6.9	3.1	<0.1	<0.1	4.2	14.2	70	6.6	0.60	14.0	38.7	56.9	7.3	11.0	4.2	4.6	2.0
2 1/2-6	B ₁	12.8	7.1	0.3	<0.1	4.2	24.4	83	6.3	0.52	32.5	29.7	43.2	7.6	10.4	3.4	2.0	0.9
6-19	B ₂	15.4	9.3	0.4	<0.1	2.4	27.5	91	6.7	0.37	38.2	27.7	39.2	7.9	9.2	2.6	2.0	0.9
19-31	B ₃	16.7	9.4	0.2	<0.1	0.4	26.7	98	7.5	0.23	27.0	34.4	49.1	8.3	9.3	2.7	2.3	1.3
31-39	C ₂	20.2	6.6	0.2	<0.1	0.0	27.0	100	7.7	0.16	25.8	36.5	51.8	8.2	8.6	2.4	2.3	0.9

Alderwood loam--Brown Podzolic

Collectors: Leighty, Ness, Roberts, and Wheeting. Sunday, June 19, 1949, 2:00 p.m., cloudy with some rain.

Location: Snohomish County, Washington, SW 1/4 NW 1/4 sec. 30, T. 31 N., R 6 E., which is 2 miles east of Edgcomb or 4.4 miles south of Arlington. Site is 1.4 miles south of sign on Granite Falls-Arlington highway which reads "Granite Falls 9 miles, Arlington 3 miles." Sample collected on west side of road by 3 Douglas fir trees 300 ± years old and about 200 feet high.

Elevation: About 300 feet.

Relief: Gently undulating morainic topography; overall slope nearly level but microrelief pitted with swells and troughs or cradle knolls 2 to 6 feet in elevation. Many old fallen trees or windfalls ranging from 6 feet in diameter and 100 feet long to fence size poles. Very difficult to walk 20 feet in any direction without climbing over a big fallen tree.

Vegetation: Dominantly dense second-growth western hemlock and western red cedar, with a few virgin Douglas fir; some second and third growth alder and vine maple. Understory consists of salal, red huckleberry, sword fern and a variety of mosses.

Drainage: Well drained; low surface runoff; moderate internal drainage to compact till, then water moves downward very slowly but may move laterally rapidly. Rapid infiltration and moderately rapid to rapid permeability.

Parent material and age: Vashon glacier till of Wisconsin age consisting of compact gray sandy till, mostly of dark-colored, fine-grained, basic rocks but with a mixture of granitic rocks and gravel. Some of the rocks and gravel are coated along cleavage planes with MnO_2 . Many of the gravels are splotted with ironlike veneer which apparently has considerable MnO_2 . In places considerable large boulders even on surface.

Biological activity: Considerable mold or fungi and ants. Some beetles but no earthworms.

Climate: At Everett, Washington 12 miles southwest of sample site and about 150 feet lower elevation, January average temperature 38.0°F ., July average 61.9°F . Growing season 213 days. Average annual precipitation for 24-year period 32.74 inches divided as follows: January 4.56, February 3.14, March 3.47, April 2.45, May 1.99, June 1.63, July .78, August 1.0, September 1.89, October 3.01, November 3.78, and December 5.04. The rains are gentle with many drizzles; considerable fog. Average annual snowfall approximately 10 inches. Wind average about 7 or 8 miles an hour and mostly from the west.

Profile: S49-Wn-31-1

S49-Wn-31-1-1

A_0	2-0"	L. F. and H. layers. Mat of mosses and needles dominantly western hemlock, some of which are partially decomposed; very dark grayish brown (10YR 3/2 and very dark brown, 10YR 2/2, when moist). pH 4.8; slight digestion with H_2O_2 . Considerable roots in this layer and some mold or fungi. Variable in thickness over plot 3 feet square. Abrupt change to layer below. No A_1 layer.
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S49-Wn-31-1-2

A_2	0-1/2"	Light gray (10YR 7/2; light brownish gray, 10YR 6/2, when moist) structureless nonplastic fine sandy loam; pH 4.8; moderate digestion with H_2O_2 . Water appears to penetrate this layer readily in field, but a drop of water on the air dry sample rolls off and penetration is difficult. This layer was exceedingly hard to collect and considerable or-
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ganic matter from the layer above was mixed with the sample; also, the color of the sample is darker than the color in place in the field. The sample was sifted through a screen and all litter discarded, but some of the fine material mixed with the gray mineral soil. Abrupt boundary to layer below but very wavy. This layer ranges from a veneer 1/32 inch to 3/8 inch over a distance of 3 feet square.

S49-Wn-31-1-3

B₂₁ 1/2-1 1/2"

Yellowish brown (10YR 5/4; dark yellowish brown, 10YR 3/4, moist) very weakly developed soft indistinct medium granular or soft crumb very slightly plastic light loam with some angular gravel, but probably not sufficient to classify the soil as gravelly loam. This layer has from 15 to 25 percent small strong-brown accretionary shotlike pellets ranging from 1/10 to 1/4 inch in diameter. Most of them are rounded but some are elongated. All are soil covered and slightly rough and most of them can be crushed between the fingers. They contain considerable MnO₂, as well as silt and sand grains. Throughout this layer is distinct firm strong-brown orterde lumps 1/4 to 1/2 inches across which are light weight and irregular in shape. This layer has a pH of 5.2, and digests moderately with H₂O₂. This layer grades into layer below.

S49-Wn-31-1-4

B₂₂ 1 1/2-7"

Light yellowish brown (10YR 6/4; dark yellowish brown, 10YR 4/4, moist) slightly plastic soft indistinct granular or fine crumb loam with many single grains and about 10 percent gravel. Similar in shot content to layer above, but appears to have less iron and organic matter. pH 5.5 and slight digestion and effervescence with H₂O₂. No noticeable orterde. Layer somewhat fluffy and grades into layer below.

S49-Wn-31-1-5

B₃₁ 7-17"

Light yellowish brown or pale brown (10YR 6/4 to 7/4; yellowish brown to dark yellowish brown, 10YR 4/4, moist) very slightly plastic gravelly light loam; mostly single grained, with some distinct water-stable irregular shaped aggregates 1/4 inch in diameter. Possibly 5 percent shot. Gravel clay-and iron-coated, mostly dark colored and very little weathered. pH 5.5, and very slight effervescence with H₂O₂. Grades into layer below.

S49-Wn-31-1-6

B₃₂ 17-32"

Similar in color, structure, and consistence to layer above but lighter in texture and has higher pH. It is gravelly sandy loam with pH 6.1. Very abrupt change with layer below; contact somewhat wavy but in general long gentle waves.

S49-Wn-31-1-7

C₁₁ 32-34"

Light brownish gray (2.5Y 6/2; olive brown, 2.5Y 4/4, moist) dense hard platy siliceous gravelly fine sandy loam, which is nonplastic and will cause a crowbar to bounce when hit from above, but the soil material can be crushed fairly easily between the fingers and broken from larger chunks to smaller ones. This layer is somewhat vesicular and the coatings of root holes and air passages are strong-brown in color, a very distinct contrast to the light brownish gray basic color of most of the layer. Roots, both fibrous and ones 1/2 inch in diameter are concentrated in a horizontal position on top of this layer into a root mat. The gravels between 1 and 2 mm. are much cleaner than gravels above; many of them are rounded. Some of the larger ones are iron and clay coated. Shot could not be detected. pH 6.4; and no effervescence with H₂O₂. This is the most compact and hard layer in the profile.

C₁₂ 34"-/

Light gray (2.5Y 7/2; olive brown, 2.5Y 4/4, moist) dense hard compact gravelly nonplastic sandy loam till with some iron stained gravel, some of which are upper limit of gravel and some are cobbles. Most of the gravels are dark, some are green. pH 6.4. As observed from the deep road cut this material extends to 75 or more feet without change in color, texture or consistence.

Remarks: Roots are very numerous in all layers except below the compact semicemented till. They appear to form a network. The outstanding characteristics of this profile are the fairly thick leaf mat, thin but distinct continuous gray A₂ horizon, ill-defined orterde layer, abundant shot, and platy hardpan of the till below a distinct root mat. There is no abrupt change in texture, color, or consistence from the B₂ horizon to C horizon.

This profile as observed in the field is distinctly beyond the modal for the Brown Podzolic but it is not considered as a minimal Podzol. Many sites of the Alderwood soils were observed that had as strongly developed A₂ and B₂ horizons, based on thickness and continuous A₂ horizon and amount of orterde, or what appeared to be orterde, firm strong-brown lumps immediately below the A₂ horizon.

Alderwood loam

Snohomish County, Washington

(Brown Podzolic)

S49-n-31-1-1 to 1-8

Lab. Nos. 49722 to 729

Depth Inches	Horizon	M.E./100 Grams Soil					% B. SAT	pH	% O.C.	Size Classes %					
		Ca	Mg	K	Na	H	S+			Clay	III	USDA Silt	VFS	FS	VCS
2-0	A ₀	--	--	--	--	--	--	4.0	--	--	--	--	--	--	--
0-1/2	A ₂	6.0	1.2	0.6	0.2	28.7	36.7	4.7	7.0	7.3	27.7	45.3	13.8	15.3	6.5
1/2-1 1/2	B ₂₁	3.0	0.5	0.2	0.1	21.4	25.2	5.7	2.70	5.1	26.0	44.4	13.9	15.4	6.9
1 1/2-7	B ₂₂	0.8	0.1	0.2	0.1	16.3	17.5	5.6	1.49	3.9	25.5	44.3	14.5	15.8	6.8
7-17	B ₃₁	0.4	<0.1	0.2	0.1	16.5	17.2	4	1.03	3.4	26.4	44.7	14.5	15.7	6.9
17-32	B ₃₂	0.4	0.1	0.2	0.1	13.6	14.4	5.4	0.90	3.2	23.4	40.9	14.3	17.5	7.9
32-34	C ₁₁	0.6	0.1	0.2	0.1	5.5	6.5	5.7	0.23	1.8	17.8	35.5	15.6	20.1	9.1
34 +	C ₁₂	1.4	0.4	0.3	0.2	5.1	7.4	6.2	0.13	2.6	19.2	35.5	18.1	20.8	8.4
															5.9

Everett gravelly sandy loam--Brown Podzolic

Collectors: Leighty, Ness, Roberts, and Wheeting. June 20, 1949.

Location: Snohomish County, Washington, SW 1/4 SW 1/4 sec. 19, T. 27 N. R. 7 E., 3 miles south of Monroe. Sample collected about 30 feet north of a big gravel pit on 10 percent slope near the upper rim.

Elevation: 400 feet.

Relief: Overall slope 8-15 percent, average about 10 percent, with many small swells and troughs. Considerable dead wood but not nearly so much as at sample site of Alderwood loam.

Vegetation: Nearly 80 percent second growth western hemlock about 10 inches indiameter. Some Douglas fir and western red cedar. Some of the old stumps are 2 1/2 to 3 feet in diameter. No alder or vine maple. Understory of salal and ferns, with roots and moss. Sample collected under a dense stand of third growth hemlock barren of undergrowth.

Drainage: Well drained; low surface runoff, excessive internal drainage, rapid infiltration, rapid permeability.

Parent material and age: Vashon glaciation, Wisconsin age, glacial outwash. In the gravel pit near where the sample was collected semicemented gray till occurs at depths ranging from 5 to 20 feet, but in general the area is old glacial outwash terrace. Rocks and gravel are dominantly dark, smooth, and rounded, with some granite.

Biological activity: Very little observed other than ants.

Climate: At Snohomish, Washington, elevation 100 feet, which is 9 miles northwest of sample site, the January average temperature is 37° F., July average 61.6°; growing season 179 days; annual precipitation for an average of 20 years 42.96 inches, divided as follows: January 5.28, February 4.63, March 3.88, April 3.30, May 2.90, June 2.44, July 1.33, August 1.34, September 2.34, October 3.49, November 6.20, December 5.83. The rains are gentle with many drizzles; considerable fog. Average annual snowfall 14.9 inches.

Profile:

S49-Wn-31-2-1

A ₀	2-0"	Very dark grayish-brown (10YR 3/2; very dark gray, 10YR 3/1, when moist) fibrous mixture of moss, leaves, twigs, and bark. Underlain by about 1/8" undecomposed hemlock. pH 4.5; moderate digestion with H ₂ O ₂ . Abrupt change to layer below.
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S49-Wn-31-2-2

A ₂	0-1 1/2"	Gray (10YR 6/1; gray, 10YR 5/1, when moist) weakly granular non-plastic friable very fine sandy loam or sandy loam. This sample has considerable organic matter from layer above but very little mixture of the B ₂ layer from the layer below. This layer is exceedingly difficult to collect. It is continuous but ranges from a film to rarely over 1/2 inch in thickness. pH 4.8; moderate digestion with H ₂ O ₂ .
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S49-Wn-31-2-3

B ₂₁	1/2-4"	Light yellowish-brown (10YR 6/4; dark yellowish-brown, 10YR 4/4, when moist) friable nonplastic very gravelly coarse sandy loam, marbled with strong-brown (7.5YR 5/6) very weakly cemented ortstein or orterde; breaks into very weakly coarse granular or fine nuciform aggregates. Considerable shot. pH 5.0; moderate digestion with H ₂ O ₂ . Grades into layer below.
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S49-Wn-31-2-4

B₂₂ 4-10" Light yellowish-brown (2.5Y 6/4; light olive brown, 2.5Y 5/4, when moist) single grained friable nonplastic gravelly sandy loam, somewhat mixed with pale brown and strong-brown. pH 5.5; moderate digestion with H₂O₂.

S49-Wn-31-2-5

B₃₁ 10-23" Pale yellow (2.5Y 7/4) to light yellowish-brown (10YR 6/4; yellowish-brown, 10YR 5/4, to dark yellowish-brown, 10YR 4/4, when moist) friable loose single-grained nonplastic gravelly loamy coarse sand with very few shot. pH 6.0 with slight digestion with H₂O₂.

S49-Wn-31-2-6

B₃₂ 23-40" Pale yellow (2.5Y 7/4; yellowish-brown, 10YR 5/4, when moist) single-grained very friable nonplastic loose stained gravelly sandy loam; pH 6.0; slight digestion with H₂O₂.

S49-Wn-31-2-7*

C 40-52" Pale yellow (2.5Y 7/4; light olive brown, 2.5Y 5/4, when moist) loose porous very gravelly loamy sandy or loamy coarse sand. Approximately 50 percent gravel. pH 6.0. Very little or no effervescence with H₂O₂. This layer rests on semicemented till but apparently it has not affected the upper part of the profile.

Remarks: This soil is distinctly more podzolic than sample No. S49-Wn-17-4, Everett gravelly sandy loam from King County, as indicated by a distinct A₂ horizon and lumps of orterde. However, it appears to be typical of the soils called Brown Podzolic in the Puget Sound area which have many shotlike concretions. The outstanding characteristic of this profile is the iron-manganese and clay-coated gravel to a depth of about 40 inches. The clay coating around the gravels is yellowish brown (10YR 5/6). Rocks on the surface are quite acid, pH 5.5. The A₂ layer is very abrupt from layers above and below, but all other layers change very gradually to the layers above and below. The B₂ is somewhat wavy. Approximately 10 percent of the shot is in the upper 20 inches. Most of the shot is small. About 10 percent of the rocks were 4 inches or more in diameter. Many of them were basic. Roots fairly well distributed but about 60 percent in the upper 4 inches.

Everett gravelly sandy loam

Snohomish County, Washington

(Brown Podzolic)

S49Wh-31-2-1 to 2-7

Lab. Nos. 49731 to 737

Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %						
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	VCS
2-0	A ₀	--	--	--	--	--	--	--	3.6	--	--	--	--	--	--	--	--	--
0-1/2	A ₂	1.8	0.2	0.2	0.2	21.5	23.9	10	4.0	3.76	6.6	16.4	26.3	9.8	16.5	10.7	19.1	11.0
1/2-4	B ₂₁	1.0	0.1	0.2	0.2	18.2	19.7	8	4.9	1.83	7.9	15.4	23.8	8.6	15.3	10.5	18.6	15.3
4-10	B ₂₂	1.0	0.1	0.1	0.1	12.2	13.5	10	5.3	0.96	6.6	12.7	20.3	8.0	15.5	11.8	20.8	17.0
10-23	B ₃₁	0.6	0.1	0.1	0.1	9.4	10.3	9	5.5	0.55	6.0	11.2	17.5	6.4	12.0	9.7	22.6	25.8
23-40	B ₃₂	0.6	<0.1	0.1	0.1	10.1	10.9	7	5.5	0.56	6.2	14.2	22.4	8.2	13.5	10.3	20.7	18.7
40-52	C	0.6	<0.1	0.1	0.1	7.7	8.5	9	5.4	0.38	5.6	9.5	14.7	5.1	9.9	11.0	27.0	26.7

Klaus gravelly sandy loam--Podzol

Collectors: Leighty, Ness, Roberts, Wheeting, June 21, 1949.

Location: King County, Washington, SW 1/4 SW 1/4 sec. 7, T. 23 N., R. 9 E., 3 miles east of North Bend, Washington. Sample collected on south side of road just east of township line. Site is adjacent to an old road and just south of a 200-year old tree stump. Boulders are very conspicuous in this area. Some are 2 feet in diameter.

Elevation: 800 feet.

Relief: Gently sloping to undulating old terrace, 2 to 3 percent slopes. Many mounds, some very gravelly and stony.

Vegetation: This area logged about 1910. Now producing Douglas fir 6 to 8 inches in diameter, about 30 years old, and alder 4 inches in diameter, about 11 years old. Some vine maple, hemlock and a few western red cedar. Very little undergrowth but thick matted moss and fir needles.

Drainage: Excessively drained. Low surface runoff. Excessive internal drainage. Rapid infiltration; rapid permeability.

Parent material and age: Probably gravelly and stony stream terrace or glacial outwash from Cascade glacial terminal moraine, which is about 1 mile east. Age uncertain. Gravel and rocks mostly fine-grained basaltic but are acid inside, as indicated by Hellige indicator. Many of the rocks are angular and even many of the sand-sized grains are angular and flat.

Biological activity: Very little visible activity. Some ants, no earthworms and very little or no fungus.

Climate:¹ Approximate January average 35° F., July average 63° F. Growing season 157 days. Annual precipitation 65 inches, divided as follows: January 10.0, February 6.5, March 6.5, April 4.2, May 3.5, June 2.7, July 1.0, August 1.6, September 3.2, October 6.3, November 8.7, December 10.8. The snowfall is approximately 25 inches.

Profile:

S49-Wn-17-1-1

A ₀	2-0"	Very dark grayish-brown (10YR 3/2; nearly black, 10YR 2/1, when moist) loose fibrous mat of moss, fir needles, and some alder leaves, and many roots. pH 5.0; moderate digestion with H ₂ O ₂ . Abrupt change to layer below.
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S49-Wn-17-1-2

A ₂	0-1 1/2"	Gray (10YR 6/1; dark gray, 10YR 4/1, when moist) single-grained friable loose gravelly light sandy loam, pH 4.5, moderate digestion with H ₂ O ₂ . Abruptly changes to layer below.
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S49-Wn-17-1-3

B ₂₁	1 1/2-4 1/2"	Brown (10YR 5/3; strong-brown 7.5YR 4/6, when moist) firm to compact slightly plastic gravelly sandy loam. No distinct water stable structural units, but many lumps of softly cemented ortstein which is dark reddish-brown (5YR 3/4, when moist). Sand grains angular. Very few or no shot. pH 5.8; moderate digestion with H ₂ O ₂ . Gradual change to layer below.
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¹The climate is determined by interpolating the data at Snoqualmie Falls 6 miles east, elevation 430 feet, and at Snoqualmie Pass 15 miles east, elevation 3,040 feet.

S49-Wn-17-1-4

B₂₂ 4 1/2-13"

Similar to layer above; not quite so firm, has less roots and probably less organic matter. pH 5.8; slight effervescence with H₂O₂.

S49-Wn-17-1-5

B₃ 13-23"

Light yellowish-brown (10YR 6/4; dark yellowish-brown, 10YR 3/4, when moist) very gravelly and stony sandy nonplastic loam. No distinct structure. Soil firm in place but very loose and porous. pH 5.8. Very slight effervescence with H₂O₂.

S49-Wn-17-1-6

C₁₁ 23-36"

Olive (5Y 5/3) and pale yellow (5Y 7/3) very loose nonplastic single-grained gravelly sand. When moist it is olive (5Y 4/3) and pale olive (5Y 6/3). The colors in this layer are distinctly mixed, which appears to be due to a stain from iron oxides. pH 6.2; slight effervescence with H₂O₂.

S49-Wn-17-1-7*

C₁₂ 36-48"

Olive (5Y 5/3) and pale olive (5Y 6/3) very loose nonplastic single-grained gravelly sand. When moist olive (5Y 4/3 and 5Y 5/3). More olive colored and looser sand than layer above. Lots of dark mineral. pH 6.2; no effervescence with H₂O₂.

Remarks: This profile is very stony and excessively drained. It has the characteristics of a typical well drained Podzol, as indicated by distinct thick continuous A₂ horizon and distinct firm lumpy ortstein B₂ horizon, strongly acid A₂, and acid A₀. Roots are large and numerous to 23 inches. Very few shot, although there are a few small soft ones in the upper part of the profile. All layers are very gravelly and stony.

Klaus gravelly sandy loam King County, Washington (Podzol)

S49/in 17-1-1 to 1-7		Lab. Nos. 49739 to 745																
Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
2-0	A ₀	--	--	--	--	--	--	--	4.9	--	--	--	--	--	--	--	--	--
0-1 1/2	A ₂	0.6	0.1	0.4	0.1	15.0	16.2	7	4.3	1.67	3.5	12.1	19.4	9.3	20.1	30.8	15.9	1.0
1 1/2-4 1/2	B ₂₁	0.8	0.1	0.2	0.2	25.1	26.4	5	5.2	2.71	4.1	9.2	14.4	6.4	13.3	31.1	27.2	3.5
4 1/2-13	B ₂₂	0.4	0.1	0.2	0.1	24.5	25.3	3	5.4	2.31	5.1	15.1	24.7	13.2	17.8	14.2	15.5	9.5
13-23	B ₃	0.4	0.1	0.2	0.1	23.1	23.9	3	5.6	1.71	4.8	15.6	25.6	15.4	19.4	10.4	13.4	11.0
23-36	C ₁₁	0.2	0.1	0.1	0.1	8.5	9.0	6	5.5	0.66	2.6	3.6	7.5	7.3	18.7	13.4	21.2	29.3
36-48	C ₁₂	0.2	0.1	0.1	< 0.1	5.3	5.7	7	5.6	0.38	2.3	1.7	4.2	6.7	21.4	15.6	24.4	25.4

Klaus fine sandy loam² -- Podzol

Collectors: Leighty, Ness, Roberts, and Wheeting, June 22, 1949.

Location: King County, Washington, NE 1/4 SE 1/4 Sec. 4, (this is a very small section) T. 23 N., R. 9E. Approximately 6 miles straight east of North Bend, Washington. Sample collected on hill slope 40 feet on northwest side of road, approximately 1/10 mile from section line between section 3 and 4. This sample just 3 miles east on the same road as the sample of Klaus gravelly sandy loam. This road is on the north side of the Middle Fork Snoqualmie River.

Elevation: Approximately 1,600 feet.

Relief: High gently undulating terrace or terminal moraine. Sample collected on 10 to 15 percent east-facing slope that has many mounds or cradle knolls. Exceedingly difficult to traverse this area owing to uneven relief and fallen timber.

Vegetation: Very dense stand of timber mostly western hemlock, with some fir, vine maple and western red cedar. Considerable undergrowth of ferns, salmonberry, and Devils foot. The cover is so dense that the ground is shaded most of the time and it is cool even during the hottest periods. Numerous decayed and partially decayed logs, some 3 to 6 feet in diameter.

Drainage: Well drained; low surface runoff; moderate internal drainage; rapid infiltration; and rapid permeability. But the soil was moist in June and probably stays moist throughout the year, but not to the extent that it causes poor oxidation and mottling.

Parent material and age: Mixed granitic, sedimentary, and basic material from local mountain glaciation on probably terminal moraine of about Wisconsin age. The gravels are dominantly quartzite, rhyolite, shales and some andesites; most of them are subangular. There is a possibility that upper layers of the profile may have some pumice, but if they do it is a very small amount.

Biological activity: Very little visible activity; some ants, no earthworms, and little or no mold.

Climate: Temperature in shade at noon June 22 was 60°F, and at a depth of 3 inches in the profile the temperature was 48°F. Very little change to depth of sampling. Approximate climate³, January average temperature 32°F., July average 61°F. Growing season 143 days. Annual precipitation 76 inches, divided as follows: January 12 inches, February 8.0, March 8.0, April 4.5, May 3.6, June 3.1, July 1.0, August 1.8, September 3.5, October 7.5, November 10.0, December 13.0. The rains are steady, with considerable fog. Snowfall approximately 84 inches, the same as reported for station near Cedar Lake, elevation 1,560 feet.

Profile:

S49-Wn-17-2-1

A ₀	2-0"	Very dark grayish-brown (10YR 3/2; black, 10YR 2/1, moist) highly decomposed leaf mat of hemlock needles and moss, with a loose covering of needles. This layer has a pH of 4.5, and moderate digestion with H ₂ O ₂ . Many roots 1/16 to 1/4 inch in diameter make a network at the junction of this layer and the layer below. The contact with layer below is very abrupt.
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² This sample was called a fine sandy loam owing to the 0-3 inch layer; however, the layers below appear to be a gravelly sandy loam. The soil was mapped Klaus gravelly sandy loam.

³ The climate is determined by interpolating the data at Snoqualmie Falls, elevation 430 feet, 9 miles west and Snoqualmie Pass, elevation 3,040 feet, approximately 12 miles east.

A₂ 0-3" Typical gray layer of Podzols ranging from light gray (10 YR 7/1) to dark gray (10 YR 4/1) and when moist from gray (10 YR 5/1) to very dark gray (10 YR 4/1) siliceous structureless nonplastic fine sandy loam that has less clay than layers below. This layer has a pH of 4.0 and digests moderately with H₂O₂. The sample is slightly darker colored than most areas in the field because some of the darker colored leaf mat from above was mixed with it in sampling; however, little or no layer from below was mixed with this layer.

S49-Wn-17-2-3

B₂₁ 3-7" Dark brown (7.5YR 4/4; dark reddish brown, 5YR 3/4, moist) firm to hard weakly cemented massive to very weakly nuciform nonplastic gravelly sandy loam. This layer is light weight and appears to have considerable organic matter and iron. The aggregates are water stable and many of the lumps appear to be ortstein and do not readily break down when submerged in water but they are not like an ironpan. No shot observed in this layer and not so many roots as in layer above. pH 5.0; moderate digestion with H₂O₂, delayed action.

S49-Wn-17-2-4

B₂₂ 7-20" Similar in color, texture, and consistence to layer above but more cemented ortstein and more lumpy, less organic matter. Very light weight granules and lumps 1/4 to 1 inch, angular and rounded. This layer is somewhat banded with gray specks, possibly pumice, but doubtful. pH 5.0; slight effervescence with H₂O₂. Grades into layer below.

S49-Wn-17-2-5

B₃ 20-36" Brown (7.5YR 4/3; dark brown 7.5YR 3/3 moist) friable single grained to blocky nonplastic very gravelly sandy loam. The gravels are angular and sharp-sided, ranging from 2 to 10 mm. and consisting of a mixture of many kinds, mostly dark colored and somewhat clay-coated. About 80 percent of soil is gravel. pH 6.0; no reaction with H₂O₂.

S49-Wn-17-2-6

C 36-46" Brown (7.5YR 5/4; dark brown 7.5YR 4/4 moist) friable single grained nonplastic very gravelly sandy loam. pH 6.0; no reaction with H₂O₂.

Remarks: This profile appears to be a strongly developed well drained Podzol as indicated by thick gray A₂ and fairly thick organic B₂₁ and semicemented ironpan B₂₂. The B₂₁ and B₂₂ are very lightweight and are cold and moist, probably staying wet all year. There is a possibility that the layers from 0 to 20 inches are of different material from lower layers as indicated by few gravels. There is a faint possibility that some pumice may be mixed with the upper part of this profile; however, the same expression of Podzol would probably occur.

King County, Washington

Klaus fine sandy loam

Lab. Nos. 49746 to 751

S49Wn 17-2-1 to 2-6

Depth Inches	Horizon	M.F./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
2-0	A ₀	--	--	--	--	--	--	--	3.8	--	--	--	--	--	--	--	--	--
0-3	A ₂	1.2	0.2	0.1	0.1	27.7	29.3	5	4.2	6.4	4.1	13.5	21.9	9.3	20.5	26.3	17.0	0.9
3-7	B ₂₁	0.2	0.1	0.1	0.2	55.4	56.0	1	4.7	8.1	3.1	15.3	22.7	7.6	19.2	30.5	15.9	1.0
7-20	B ₂₂	0.4	0.2	0.1	0.1	63.2	64.0	1	4.8	9.4	5.0	13.6	19.9	8.6	15.8	29.1	19.5	2.1
20-36	B ₃	0.2	0.1	0.1	0.2	41.9	42.5	1	5.2	5.7	4.1	17.8	28.4	15.0	17.5	10.8	12.2	12.0
36-46	C	0.2	0.1	0.1	0.1	47.4	47.9	1	5.4	5.2	3.2	13.6	21.6	12.2	23.3	13.6	13.5	12.6

Alderwood gravelly sandy loam--Brown Podzolic

Collectors: Leighty, Ness, Roberts, and Wheeting. June 22, 1949, 10:00 a.m. to 12:00 noon, cloudy.

Location: King County, Washington, SE 1/4 SW 1/4 sec. 9, T. 26 N., R. 6 E., approximately 3 1/2 miles west of Duval, Washington, on highway 2 C, Duval to Bothell. Sample collected on north side of road on deep road cut 30 feet high. This sample site is just 5 1/2 miles southwest of the site of Everett gravelly sandy loam, No. S49-Wn-31-2.

Elevation: 500 feet.

Relief: Sample collected on steep-sided flat-top hill where the slope was not more than 5 percent. No noticeable swells or cradle knolls or fallen timber.

Vegetation: Very dense growth of second growth Douglas fir and some hemlock, with a few vine maples and willows and big leaf maple. Most of the trees were from 4 to 6 inches in diameter. The sample site had very little undergrowth, probably because of lack of light. Oregon grapes, salal, and huckleberry were growing on road bank where there was more light.

Drainage: Well drained; low surface runoff at sample site and moderate internal drainage to the compact till. Rapid infiltration; moderately rapid to rapid permeability.

Parent material and age: Vashon glacial till of Wisconsin age. As near as could be determined parent material is the same as that where the sample of Alderwood loam was collected.

Biological activity: Very little obvious biological activity. Some ants and beetles, no earthworms, and very little or no mold.

Climate: At Snohomish, Washington, elevation 100 feet, which is 11 miles north of sample site, the January average temperature is 37° F., July average 61.6° F, growing season 179 days, annual precipitation for an average of 20 years 42.96 inches, divided as follows: January 5.28, February 4.63, March 3.88, April 3.30, May 2.90, June 2.44, July 1.33, August 1.34, September 2.34, October 3.49, November 6.20, December 5.83. The rains are gentle with many drizzles; considerable fog. Average annual snowfall 14.9 inches.

Profile:

S49-Wn-17-3-1

A ₀	2-0"	Leaf mat consisting mostly of fir and hemlock needles, with some alder leaves and considerable moss. Very dark grayish-brown (10YR 3/2; very dark brown, 10YR 2/2, when moist). pH 5.0; strong digestion with H ₂ O ₂ . Many roots.
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S49-Wn-17-3-2

A ₂	0-1/2"	Very thin, in most places less than 1/8" thick, light gray (10YR 6/1 to 10YR 7/1) to gray (10YR 5/1; very dark gray, 10YR 3/1, when moist) single grained to fine crumb fine sandy loam or loamy fine sand. Sand grains are rounded but there is no noticeable shot; pH 4.5. This layer is not continuous and ranges in thickness from nil to 3/4 inch, grading into layer below, but it is very distinct. Moderate digestion with H ₂ O ₂ .
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S49-Wn-17-3-3

B ₂₁	1/2-7"	Brown (10YR 5/3; dark brown, 10YR 3/3, when moist) very friable fine crumb water-stable nonplastic sandy loam. Approximately 10 percent small iron and manganese shotlike concretions about 1 1/2 mm. in diameter. Also angular firm strong-brown to dark reddish-brown weakly fine nuciform order. Many fibrous roots; pH 5.5. Moderate digestion with H ₂ O ₂ . This layer grades into layer below in color and texture.
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S49-Wn-17-3-4

B₂₂ 7-22" Pale brown (10YR 6/3; dark brown, 10YR 4/3, when moist) soft very friable single-grained nonplastic gravelly sandy loam, many soft indistinct irregular lumps. Less shot than layer above; pH 6.0; moderate digestion with H₂O₂.

S49-Wn-17-3-5

B₃₁ 22-30" Pale brown (2.5Y 7/4; brown, 10YR 5/3, when moist) single-grained nonplastic friable gravelly sandy loam and loose very gravelly fine sand. Slight effervescence with H₂O₂; pH 6.1. Very few shot. Roots are not numerous except in the root mat that occurs at the junction between the lower part of this layer and the upper part of the underlying layer, which is very abrupt and wavy.

S49-Wn-17-3-6

B₃₂ 30-33" Dense platy hardpan, pale olive (5Y 6/3; olive, 5Y 4/3, when moist) faint silica and clay cemented material which is mottled brownish-yellow and gray. The upper 1 mm. is light gray and abruptly underlain by a 2 to 5 mm. of yellowish brown. In places these bands look very much like a pygmy podzol. This material does not disintegrate when placed in water. pH 6.3. No effervescence with H₂O₂.

S49-Wn-17-3-7*

C 33-40" Light gray (5Y 7/2, olive gray, 5Y 5/2, when moist) sandy semi-cemented material, very few mottlings. pH 6.2; no effervescence with H₂O₂.

Remarks: This profile is typical of many large areas of the Alderwood series in the Puget Sound area. The podzolization process is fairly well expressed but not nearly as much as shown in the profile of Alderwood loam. The gravels are not so distinctly iron-stained, the gray A₂ layer is not so thick, distinct, or continuous, the B₂ does not appear to have so much orterde and the lumps are not continuous. In places a strong-brown color is not noticeable. In this area large soft shot 1/2 inch in diameter are conspicuous and the soil is much grayer than in other places. The gray areas may be within 6 inches of strong brown-colored areas. In the B horizon strong-brown firm splotches may occur associated with loose friable material. Roots are very abundant to a depth of 22 inches. They are also abundant as a root mat directly above the platy hardpan. In practically all places in virgin and second growth timber that the Alderwood soils were examined in the Puget Sound area on this trip, there was some evidence of a gray A₂ or a sprinkling of gray below the leaf mat. Both it and the leaf mat were acid, ranging from 4.2 to 5.5 in pH.

Alderwood gravelly sandy loam

King County, Washington

(Brown Podzolic)

S49-wh-17-3-1 to 3-7

Lab. Nos. 49752 to 758

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
2-0	A ₀	--	--	--	--	--	--	--	4.6	--	--	--	--	--	--	--	--	--
0-1/2	A ₂	4.0	1.0	0.3	0.2	27.6	33.1	17	4.6	6.5	5.8	16.8	33.2	15.1	19.5	8.8	10.4	7.2
1/2-7	B ₂₁	0.8	0.4	0.1	0.2	16.2	17.7	8	5.3	1.81	4.9	16.8	32.5	16.1	19.4	8.3	10.6	8.2
7-22	B ₂₂	0.9	0.4	0.1	0.2	13.3	14.8	11	5.6	1.41	3.2	15.5	31.5	16.2	20.7	9.4	11.9	7.1
22-30	B ₃₁	0.7	0.5	0.1	0.2	7.3	8.8	17	5.6	0.59	2.0	10.9	26.3	18.1	24.4	10.3	11.0	7.9
30-33	B ₃₂	0.4	0.3	0.1	0.2	5.5	6.5	15	5.8	0.35	0.5	9.1	25.1	17.8	26.3	11.2	11.6	7.5
33-40	C	0.3	0.2	0.1	0.3	3.5	4.4	20	5.8	0.21	0.3	8.7	24.2	19.3	27.1	11.0	10.5	7.6

Everett gravelly sandy loam--Brown Podzolic

Collectors: Leighty, Ness, Roberts, and Wheething. June 22, 1949, 2:00 p.m., cloudy.

Location: King County, Washington, SW 1/4 NE 1/4 sec. 18, T. 21 N., R. 6 E., about 6 miles east of Auburn, Washington, or 1/2 mile northeast of Mooney Slough. The site is .2 of a mile southeast of road junction in the northwest corner of section 18. Sample collected on east side of road on sloping hillside in virgin timber.

Elevation: About 555 feet.

Relief: Sloping to gently rolling. Sample collected on 7 percent slope. Slightly uneven microrelief but not nearly so pronounced as where sample of Alderwood loam was collected.

Vegetation: Mainly Douglas fir, some hemlock, few western cedars and cascara. Dense undergrowth of ferns, Oregon grape, and salal. Lots of deadwood. Trees are not nearly so thick as on the Alderwood soils.

Drainage: Excessively drained; low surface runoff, excessive internal drainage, rapid infiltration, and rapid permeability.

Parent material and age: Vashon glacial outwash material of Wisconsin age. Gravels, cobbles, and rocks are of mixed material but mostly granitic and basaltic.

Biological activity: No earthworms but many ants and a few beetles.

Climate: Climate at Kent, Washington, which is approximately 8 miles northwest of sample site, January average temperature 38.4° F., July average 63.4° F. Frost free period 173 days. Average annual precipitation for a 27 year period 36.87 inches, which is divided as follows: January 5.70, February 3.58, March 3.50, April 2.47, May 1.79, June 1.62, July .68, August .82, September 1.81, October 3.70, November 5.09, December 6.11. Rains are mostly gentle with many drizzles; some fog. Average annual snowfall approximately 8.3 inches.

Profile:

S49-Wn-17-4-1

A ₀	2-0"	Very dark gray (10YR 3/1; black, 10YR 2/1, when moist) fibrous leaf mat consisting of fir needles, moss and decayed wood. pH 6.0.
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S49-Wn-17-4-2

A ₂	0-1 1/4"	Dark gray (10YR 4/1; very dark gray, 10YR 3/1, when moist) single-grained loose nonplastic friable fine sandy loam with considerable organic matter; strong digestion with H ₂ O ₂ ; pH 5.8. This layer is exceedingly thin and is not continuous even within a distance of 3 or 4 feet. Where it occurs it is very distinct from the layers above and below. In the field it is light gray in color but in sampling this layer was mixed with considerable of the humus layer above and is much darker in color than where it occurs in the field.
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S49-Wn-17-4-3

B ₂₁	1/4-6"	Brown (10YR 5/3; dark brown, 10YR 3/3, when moist) fine-grained loose friable nonplastic very gravelly light sandy loam which has considerable shot. Slight digestion with H ₂ O ₂ . pH 6.0. This layer gradually grades into the layer below.
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S49-Wn-17-4-4

B₂₂ 6-20" Pale brown (10YR 6/3; brown, 10YR 4/3, when moist) friable loose single-grained nonplastic very gravelly sandy loam, many gravels 1 to 2 1/2 inches in diameter. Effervesces slightly with H₂O₂. pH 6.0. Abrupt change to layer below.

S49-Wn-17-4-5

C₁ 20-25" Very pale brown and olive (10YR 7/3 and 5Y 5/3; light brownish gray and olive, 10YR 6/2 and 5Y 4/3, when moist) loose friable very gravelly iron-stained nonplastic rounded sand. The gravel and sand are not clay- or silt-coated. No digestion. pH 6.3. This layer grades into layer below.

S49-Wn-17-4-6 *

C₂ 25-36" Similar to layer above but less very pale brown or yellowish brown and more olive. More sand and less gravel than the layer above. Very little effervescence with H₂O₂. pH 6.3. This layer extends to very great depths. The content of sand and gravel varies from place to place, but the sand and gravels are not silt or clay coated, but to very low depths they are coated with manganese.

Remarks: This profile definitely shows the weakest podzolic development of all samples collected in the Puget Sound area as indicated by a lack of orterde layer and a very thin A₂ horizon. It occurs in the area of lowest precipitation and has the highest pH of the samples collected in this area.

Everett gravelly sandy loam

King County, Washington

(Brown Podzolic)

S49-Wn-17-4-1 to 4-6

Lab. Nos. 49760 to 765

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VGS
2-0	A ₀	--	--	--	--	--	--	--	4.9	--	--	--	--	--	--	--	--	--
0-1/4	A ₂	14.5	2.2	1.0	0.4	29.8	47.9	38	5.2	11.1	7.3	20.6	33.8	12.3	12.8	5.3	12.3	16.2
1/4-6	B ₂₁	1.8	0.5	0.3	0.3	14.4	17.3	17	5.6	1.29	6.9	14.4	23.2	9.6	11.6	5.9	19.0	23.8
6-20	B ₂₂	1.4	0.6	0.4	0.3	12.4	15.1	18	5.5	1.09	5.8	11.6	18.9	9.8	13.6	7.4	22.4	22.1
20-25	C ₁	0.6	0.3	0.1	0.3	3.7	5.0	26	6.0	0.38	2.0	1.6	3.8	1.2	4.4	9.3	41.9	38.4
25-36	C ₂	0.7	0.3	0.2	0.3	3.9	5.4	28	5.8	0.54	1.8	1.6	3.4	2.0	6.2	14.7	34.6	37.3

Crow silt loam--Gray-Wooded

Collectors: Ableiter, Gieseke, Leighty, Roberts, and Williams. July 9, 1949, 2:00 to 7:00 p.m. Clear hot day.

Location: Lake County, Montana, NE 1/4 NE 1/4 NE 1/4 sec. 5, T. 19 N., R. 19 W. Sample collected a short distance (100 feet) south of the east-west road 3 miles east of Ninepipe Reservoir.

Elevation: Approximately 2,900 feet.

Relief: Very gently sloping (2 percent gradient to the west; smooth with little or no micro-relief).

Vegetation: Second growth timber consisting of balsam fir, Douglas fir, larch, gray birch, aspen, lodgepole pine, ponderosa pine, with understory of kinnikinnick, service berry, Oregon grape, and other shrubs. Old stumps, mostly ponderosa; open areas are mostly in grass and clover. This area has been pastured. Most of standing trees are 30 to 40 years old and 3 to 9 inches in diameter. One ponderosa 15 inches in diameter was 60 years old.

Drainage: Surface drainage fair to good; moderate internal drainage; not much evidence of mottling to indicate restricted drainage but the appearance of the soil suggests it is wet and cold in winter, spring and fall. Moderate infiltration, moderate to slow permeability. Very difficult to determine infiltration and permeability.

Parent material: Moderately calcareous glacial till consisting of reworked lake sediments, gravelly in upper part, more stony below. Rocks consist of fine-grained sedimentary, such as sandstone, dolomite, shales, argillites, and quartzites; some green rocks on surface. Rocks are not coated with clay, iron, or lime, but may have some coating of MnO₂.

Biological activity: Ants and some spiders; no worms observed; very little mold or fungi.

Climate: At the weather station at St. Ignatius, Montana, which is approximately 7 miles south of sample site and at approximately the same elevation, the January average temperature is 24° F., the July average is 66.7° F. The growing season is 125 days. The average annual precipitation for a 30-year period is 15.13 inches, divided as follows: January .90, February .76, March 1.03, April 1.41, May 2.04, June 2.13, July 1.04, August 1.05, September 1.51, October 1.31, November 1.03, December .92. Annual average snowfall 45.2 inches. Some fogs, not excessively windy. Air temperature at sample site at the time of sampling 76° F.; at 5 inches below the surface of the ground 60° F., and at a 40-inch depth 52° F.

Profile: S49-Mont-24-1

S49-Mont-24-1-1

A₀₀ 1-1/4-1" Very thin litter of fir needles and leaves of ground cover plants.

A₀ 1-0" Very dark brown (10YR 3/2) woody fibrous leaf mat, pH 6.4.

S49-Mont-24-1-2

A₁ 0-1/4" Gray (10YR 5/1; very dark gray, 10YR 3/1 moist) friable very slightly plastic fine granular mucky loam. Matted with many fine roots. Very strong digestion with H₂O₂. pH 6.4.

S49-Mont-24-1-3

A₂₁ 1/4-1-1/2" Light gray (10YR 7/1; dark grayish brown, 10YR 4/2 moist) slightly plastic, faintly laminated weak granular silt loam. pH 6.8. This layer has some sharp angular sedimentary gravel 1 inch in diameter.

S49-Mont-24-1-4

A₂₂ 1-1/2-3-1/2"

Light gray to very pale brown (10YR 7/2 to 10YR 7/3; dark grayish-brown, 10YR 4/2 moist) slightly plastic laminated silt loam with small rounded soft shot of MnO₂. The aggregates and lumps have many pinhead-sized holes. Strong to very strong digestion with H₂O₂. pH 6.6. The aggregates crush readily to fine crumbs. There are many roots.

S49-Mont-24-1-5

A₃ 3-1/2-7-1/2"

Similar in texture to layer above, but perhaps slightly browner. Dry color ranges from light gray to pale brown (10YR 7/2 to 10YR 6/3). Moist color, brown (10YR 5/3). The lighter-colored material (very pale brown) forms a film up to 2 mm. thick on the top and outside of the aggregates to give a marbled appearance across the face of the profile. Massive in place, but breaks out with difficulty into irregular blocky and subangular blocky aggregates that crush with difficulty in the hand and vary in size and shape from coarse blocky to fine crumb. Strong reaction with H₂O₂. pH ranges from 6.0 to 6.4.

S49-Mont-24-1-6

B₁ 7-1/2-12"

Very pale brown (10YR 7/3; brown, 10YR 5/3 moist) slightly plastic medium blocky silty clay loam slightly marbled with gray. pH 6.4. Horizon gives browner appearance than the one above with less very pale brown (gray) along structural faces. Color of moist crushed material is the same as the above horizon. Firm in place. Digs out with difficulty with the spade into irregular blocky and subangular blocky aggregates. Crushes with difficulty in the fingers to smaller subangular blocky aggregates. Some small gravel and roots.

S49-Mont-24-1-7

B₂ 12-20"

A very pale brown and brown silty clay loam to clay (some question about texture). Brown to dark brown (10YR 5/3 to 4/3) when moist. Very pale brown (gray) films still present but much less pronounced. Coarsely prismatic structure with cracks extending vertically throughout the horizon. Dug out with greater difficulty than the layer above. Prisms break to hard blocky, and subangular blocky aggregates that cannot be crushed in the hand under present dry condition. These aggregates vary from 1/16 to 3/4" in diameter. When cut across they show small streaks and irregular bands of dark brown to dark grayish brown (10YR 4/3 to 10YR 4/2). These areas evidently contain more organic matter, and they show more MnO₂ (effervescence with H₂O₂) and they are more acid by .2 pH than adjacent material. Small pin-sized holes are very conspicuous. Some few gravel pieces, mostly with sharp edges.

S49-Mont-24-1-8

B₃ 20-28"

A firm, marbled brown and gray silty clay loam to silty clay with less defined blocky or prismatic structure in place than the layer above. Digs with difficulty with the spade and breaks into rather large irregular aggregates ranging from 4" to 1/4" in diameter in this dry condition. The more common aggregates are about 1 to 2" in diameter and are blocky to subangular blocky in shape. A very pale brown (gray) 10YR 8/4 film ranging from 1/32 to 1/8 inch in thickness covers the structural faces. These aggregates break in the hand rather readily and spots, streaks and filaments of dark brown to dark yellowish brown (10YR 4/4 to 4/3) are prominent. They form an irregular pattern. There is strong effervescence with H₂O₂. The soil feels rather light in weight. pH at top of layer is 6.6 and at the bottom is 6.9. Relatively free of gravel. There are many roots. This material may be lake-laid sediments.

C₁ 28-42"

A bed of gravel tightly embedded in a matrix of calcareous, (pH 8.2) silty clay loam till, similar in color to layer above. This till is hard and firm and breaks out with difficulty into irregular fragments of varying size. The angular gravel are mostly sedimentary and are 1+ inches in diameter. Many are soft and can be cut with a knife. This layer has many roots and root holes of pinhead size and is hard when dry and difficult to crush between the fingers. This layer is also stained with a dark-brown (10YR 4/3) veneer and pale brown (10YR 6/3) basic color. All the rocks and gravel below 30 inches are lime coated. Very few roots. In the 38-40 inch zone lots of MnO₂. pH 7.8.

Remarks: The Crow series appears to be within the range of the Gray Wooded soils. They are in many respects similar to the Breton soils. Both series have developed from heavy-textured materials and both have prismatic or weakly developed prismatic B₂ horizons, which likely causes a perched water table during parts of the year. These two series, as well as the Whitefish soils, had considerable number of black MnO₂ concretions in the upper part of the profile.

The Crow soils are the forested counterpart of the grass land Post series and they occupy similar areas. The Crow soils occur nearer the Mission Range and have been influenced more by glacial till deposits in the lower substratum than the Post soils. The Post soils possibly may be classified as a transition between Maximal Chestnuts and solodized Solonetz. Both the Crow and Post series have about the same amount of textural B development. The main differences are in the color and structure of the A horizons.

Lake County, Montana

Crow silt loam

S49Mont-24-1-1 to 1-9

Lab. Nos. 49767 to 775

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1-0	A ₀	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--	--
0-1/4	A ₁	22.1	5.4	0.9	0.3	11.8	40.5	71	6.4	7.7	16.5	50.0	72.0	5.6	2.8	0.9	1.2	1.0
1/4-1 1/4	A ₂₁	7.3	2.5	1.1	0.1	8.8	19.8	56	5.9	2.27	16.0	52.1	74.5	4.8	1.7	0.7	1.2	1.1
1 1/4-3 1/2	A ₂₂	5.2	1.2	1.0	0.1	6.6	14.1	53	5.8	1.13	17.4	50.7	73.0	5.0	1.8	0.8	1.1	0.9
3 1/2-7 1/2	A ₃	5.4	1.0	0.9	0.1	5.4	12.8	58	5.6	0.66	20.2	48.1	70.0	5.3	1.8	0.7	0.9	1.1
7 1/2-12	B ₁	8.3	1.8	0.8	0.1	4.5	15.5	71	5.8	0.42	28.0	43.2	62.8	4.5	1.8	0.8	1.0	1.1
12-20	B ₂	10.9	2.6	0.7	0.1	4.5	18.8	76	5.8	0.27	34.8	36.2	58.8	4.3	1.1	0.4	0.4	0.2
20-28	B ₃	16.4	2.8	0.7	0.2	4.1	24.2	83	6.7	0.36	36.4	46.6	59.5	2.0	0.9	0.3	0.4	0.5
28-42	C	23.3	2.2	0.4	0.2	2.8	28.9	93	8.0	0.18	34.7	33.0	45.2	6.3	5.2	2.5	3.2	2.9

Crow gravelly silt loam--Gray Wooded

Collectors: Ableiter, Gieseke, Leighty, Roberts, and Williams. July 10, 1949, 8:00 a.m. to 2:00 p.m., bright sunny day.

Location: Lake County, Montana, SE 1/4 SE 1/4 SE 1/4 sec. 32, T. 21 N., R. 19W., 2.0 miles east of Ronan, Montana. Sample site 400 feet north of east-west road and 450 feet west of north-south fence on section line. Mission Range to the east.

Elevation: Approximately 2,900 feet.

Relief: Very gently sloping, 3 percent, to the west, with some irregular microrelief due to fallen trees; some swales to north and west.

Vegetation: Open stand of second growth trees, such as balsam fir, Douglas fir, lodgepole, ponderosa, larch; some broad leaf trees, with understory of kinnikinnick, snow-berry, service berry, lupine, Oregon grape, and grass. Area used for pasture; white clover and grass in open areas. Some fallen logs but not excessive. Not much moss on ground or on trees.

Drainage: Surface drainage fair to good; moderate internal drainage; not much evidence of mottling to indicate restricted drainage but soil has appearance of being wet and cold in winter, spring and fall. Moderate infiltration, moderate to slow permeability. Very difficult to determine infiltration and permeability.

Parent material: Glacial till consists of reworked lake sediments, gravelly in upper part, more stony below. Rocks consist of fine-grained sedimentary, such as sandstone, dolomite, shales, argillites, and quartzites, some green rocks on surface. Valley (cordilleran) glaciation; rocks rounded. Rocks are not coated with clay, iron or lime, but may have thin coating of MnO_2 . Till calcareous at 40 to 50".

Biological activity: Many wood ants 1/4 inch; some wing ants; some black carpenter ants; and spiders. Very little evidence of worms and mycelium. Many logs destroyed, presumably by ants, molds, freezing, thawing, and general decomposition.

Climate: At the weather station at St. Ignatius, Montana, which is approximately 15 miles south of sample site and approximately at the same elevation, the January average temperature is $24^{\circ}F.$, the July average is $66.7^{\circ}F.$ The growing season is 125 days. The average annual precipitation for a 30-year period is 15.13 inches, divided as follows: January .90, February .76, March 1.03, April 1.41, May 2.04, June 2.13, July 1.04, August 1.05, September 1.51, October 1.31, November 1.03, and December .92. Annual average snowfall 45.2 inches. Some fogs; not excessively windy. Air temperature at sample site at the time of sampling was $78^{\circ}F.$; at 3 inches below the surface it was $54^{\circ}F.$, and at 4 feet below the surface it was $52^{\circ}F.$

Profile: S49-Mont-24-2

S49-Mont-24-2-1

A₀ 1/2-0" Dark gray (10YR 4/1); very dark gray (10YR 3/1) moist decomposed leaves, bark, and grass roots; the fluffy organic mat consists of 1/4 inch of L, 1/2 inch F, and 1/4 inch H, and is composed largely of fir needles. pH 6.2 by B.T.B. Moderate digestion with H^2O^2 .

S49-Mont-24-2-2

A₁ 0-1/4" Gray (10YR 5/1; very dark gray, 10YR 3/1, moist) friable slightly plastic silt loam of mixed weak granular and weak fine crumb structure. The granules consist of bits of the underlying A² horizon. There are many small roots. Moderate digestion with H^2O^2 .

S49-Mont-24-2-3

A₂₁ 1/4-1 1/2"

White (10YR 8/2; light gray, 10YR 7/2, crushed; dark grayish brown, 10YR 4/2, moist) granular, friable and slightly plastic gravelly silt loam with weak thin plates or lamina which are darker on under side than on the upper side. This horizon is difficult to collect with its irregular, but distinct boundary, pockets, and some overlapping of layers. There are very numerous roots. pH 6.8. Strong reaction with H₂O₂.

S49-Mont-24-2-4

A₂₂ 1 1/2-5 1/2"

Light gray (10YR 7/2; grayish-brown, 10YR 5/2, moist) slightly hard silt loam with weak to moderate platy structure. pH 6.6. Moderate to strong digestion with H₂O₂, greater than A₂₁ but less than A₃. Fairly soft numerous manganese concretions less than 1 mm. in diameter which give a strong reaction with H₂O₂. (Note that reaction is used here for Mn in contrast to the use of digestion above for organic matter.)

S49-Mont-24-2-5

A₃ or B₁ 5 1/2-11"

Pinkish-gray (7.5YR 7/2; brown 7.5YR 5/2 moist) slightly plastic heavy silt loam with blocky structure which breaks into moderate to weak subangular blocky aggregates. These aggregates are lighter gray on the outside and have darker centers. Although the gray penetrates deeply into the aggregates in places as threads or streaks. In general, the gray material is thickest (1/4"-1/16") at the top of the layer, but coats the larger aggregates throughout the horizon. The secondary aggregates are relatively free of the gray film. Strong to very strong digestion with H₂O₂. Numerous black to very dark brown soft concretions. pH 6.7.

S49-Mont-24-2-6

B₂₁ 11-22"

Plastic silty clay or clay with coating of pinkish-gray (7.5YR 5/2, moist). The color of the inside of the aggregates was brown (7YR 5/4, moist). Weak appearing prismatic structure in place, but 2 to 3-inch columns break easily into strong medium and coarse blocky aggregates having a heavy coating of light gray to white (10YR 7/2 to 8/2) along structure breaks. Light gray coating gave a light digestion but strong effervescence with H₂O₂, which was interpreted to mean low organic matter content but high in MnO₂. Same is true for brown material throughout horizon. Light gray coating had a pH of 6.7. Inside of aggregates at the top of the horizon the pH was 6.5; at 6 inches below, the pH was 6.0. Some gravel in this layer.

S49-Mont-24-2-7

B₂₂ 22-34"

Same color, texture, structure, and consistence as layer above except for less gray coatings on surface of aggregates. pH increases from 6.5 to 6.8.

S49-Mont-24-2-8

B₂₃ 34-41"

Light gray (10YR 7/2; brown, 10YR 5/3 moist) irregular blocky plastic silty clay loam, less prismatic than layer above but more gravelly. This layer when wet has solid brown color with coatings of dark brown. Noncalcareous, but pH 8.1 with thymol blue. H₂O₂ shows organic matter on coatings and high MnO₂ in center. Quartzite and greenstone gravel.

S49-Mont-24-2-9

B_{ca} 41-46"

White (10YR 8/2; brown and light yellowish brown, 10YR 5/3 to 6/4 moist) plastic silty clay loam with lime in concretions. pH 8.5 with T.B. In general not calcareous except for the spots of visible lime. In other respects similar to layer above.

S49-Mont-24-2-10

C 46-51"

White (10YR 8/2; pale brown, 10YR 6/3 moist) highly calcareous, plastic silty clay loam. The lime is disseminated, and the horizon has a marbled yellowish brown and gray appearance with little or no distinct structure. Material digs out in various sized lumps up to about 1 inch across.

Remarks: The pH as recorded in the field are approximately .3 higher than those obtained in the office by the same methods.

This profile appears to be slightly more developed in the B horizon than the sample of Crow silt loam. The color determinations made in Berkeley are as follows:

O-1/4	10YR 4/1	Dark gray	10YR 3/1	Very dark gray
1/4-1 1/2	10YR 5/1	Gray	10YR 4/2	Dark grayish brown
1 1/2-5 1/2	10YR 6/1	Light gray	10YR 5/2	Grayish brown
5 1/2-11	7.5YR 7/2	Pinkish gray	7.5YR 5/2	Brown
11-22	7.5YR 7/2	Pinkish gray	7.5YR 5/2	Brown
22-34	7.5YR 7/2	Pinkish gray	7.5YR 5/2	Brown
34-41	10YR 7/2	Light gray	10YR 5/3	Brown
41-46	10YR 8/2	White	10YR 5/3	Brown
46-51	10YR 8/2	White	10YR 6/3	Pale brown

Crow gravelly silt loam

Lake County, Montana

(Gray Wooded)

S49Mont-24-2-1 to 2-10										Lab. Nos. 49776 to 785									
Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %								
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS	
1/2-0	A ₀	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--	--	
0-1/4	A ₁	22.8	6.9	1.2	1.6	16.2	48.7	67	6.0	8.21	15.8	47.0	66.2	7.2	4.4	1.6	2.1	2.7	
1/4-1 1/2	A ₂₁	10.0	2.5	0.8	0.1	6.0	19.4	69	6.2	2.28	18.2	47.0	64.9	6.2	3.3	1.4	2.2	3.8	
1 1/2-5 1/2	A ₂₂	8.4	2.0	0.6	0.3	5.6	16.9	67	6.1	1.65	21.2	45.8	62.8	6.4	3.2	1.5	2.3	2.6	
5 1/2-11	A ₃ or B ₁	7.6	3.1	0.8	0.1	4.8	16.4	71	6.4	0.97	26.5	41.6	57.9	6.0	3.2	1.4	2.4	2.6	
11-22	B ₂₁	9.8	5.3	0.7	0.3	5.4	21.5	75	6.1	0.43	52.0	27.9	36.8	3.9	2.6	1.1	1.5	2.1	
22-34	B ₂₂	8.9	4.7	0.6	0.6	3.6	18.2	80	6.1	0.27	49.8	34.0	41.8	3.1	1.9	0.8	1.2	1.4	
34-41	B ₂₃	8.2	6.2	0.5	0.9	2.0	17.8	89	7.0	0.23	48.7	37.6	44.9	2.7	1.6	0.5	0.8	0.8	
41-46	B ₂₄	2.8	4.7	0.6	1.2	0.3	19.6	98	8.0	0.16	52.1	35.9	42.9	2.0	1.1	0.4	0.7	0.8	
46-51	C	18.7	5.5	0.4	0.7	0.0	25.3	100	8.3	0.16	45.9	43.3	49.8	1.7	1.0	0.4	0.6	0.6	

Unnamed series, very gravelly loam¹--Brown Podzolic

Collectors: Ableiter, Leighty, Roberts, and Williams, July 29, 1949, 8:30 a.m.

Location: Glacier County, Montana, 1/4 mile north on Hilton sawmill road, which turns north from U. S. Highway 89, 1.8 miles west of Hudson Bay Pass, west of Browning, Montana. Sample collected approximately 40 feet west of road. On same ridge as sample S49-Mont-18-2.

Elevation: Approximately 5,700 feet.

Relief: Nearly level with not many microswells and sags. The sample site is just south of a fairly large seeped area that has profile characteristics very similar to a Gray Wooded soil. The site is a part of a ridge extending north and northeast from the Rocky Mountain front.

Vegetation: Second growth stand of lodgepole pine and balsam fir. Many of the trees are approximately 50 years old and 8 inches in diameter. They are 6 to 8 feet apart and about 50 feet high. Ground mat consists of bear grass and small shrubs, including blueberries. Considerable open areas dominantly of bear grass. Good reproduction of fir; some moss on pine branches.

Drainage: The drainage through the soil is good to excessive owing to the numerous rocks and gravel; low surface runoff, rapid infiltration, and rapid permeability.

Parent material: Stony medium- to heavy-textured calcareous Rocky Mountain glacial till of mixed materials but dominated by sedimentary rocks such as sandstone and limestone; also includes various colored quartzites and argillites, as well as fine-grained schists and gneiss.

Biological activity: Many small black ants; very little wood decomposition except by natural agents, such as freezing, thawing, and saturation with water. Fungi mycelia present in the A₀.

Climate: At weather station near Babb, 14 miles northwest of sample site and 1,300 feet lower elevation, the January average temperature is 17.7° F., the July average is 60.1° F., minimum -53° F., maximum 96° F. Growing season 102 days. Average annual precipitation for 32-year period is 19.43 inches, divided as follows: January .99, February .79, March 1.14, April 1.62, May 2.40, June 3.28, July 1.95, August 1.86, September 2.14, October 1.25, November 1.00, and December 1.01. Snowfall is 88 inches. The precipitation and snowfall are probably greater where the sample was taken than at Babb. Air temperature 60° F. in shade when sample was taken, 48° F. at 3 inches below the surface, and 46° F. at 57 inches.

Profile: S49-Mont-18-1-1

S49-Mont-18-1-1

A₀₀ 1-3/4" Loose litter of conifer needles and small twigs. (Not sampled)

A₀ 3/4-0" Dark brown (7.5YR 3/2 moist), leaf mat mostly of lodgepole pine needles, pH 4.4 to 4.7. Some mycelia but very little moss except on decayed limbs. Many roots and bits of charred wood. This horizon about equally divided between F and H layers.

¹ A volume of soil, 12" x 12" x 4" weighed 24 pounds and contained 9 pounds gravel 5 mm. or larger; lots of flat angular red sandstone, 1/4 to 1 inch, some 2 inches; 5 pounds between 2 mm. and 5 mm.; No shot; some rounded gravel, mostly angular.

S49-Mont-18-1-2

A₂ 0-1/2"

Light gray (10YR 7/1+) gravelly nonplastic siliceous loam with distinct to moderate platy structure. Plates are about 1/16" thick. pH 4.2. This layer is light brownish gray (10YR 6/2) when wet. It ranges from 1/16 to 1 inch in thickness within a distance of 3 or 4 inches. Many roots. Gravel is soil covered. The gravel consists of pieces of red sandstone, sandy shale and quartzite. Moderate digestion with H₂O₂.

S49-Mont-18-1-3

B₂₁ 1/2-3"

Very pale brown (10YR 7/3; brown, 10YR 4/3, moist) very gravelly heavy loam. No distinct structure in place, but material digs out easily into fluffy weak crumb aggregates. Slightly plastic when moistened. Roots are numerous. The gravel pieces are soil covered, but there is very little iron staining. Moderate to strong digestion with H₂O₂. pH 4.4.

S49-Mont-18-1-4

B₂₂ 3-9"

Pale brown (10YR 7/3; brown, 10YR 5/3 to 4/3 moist) very porous very gravelly heavy loam. Weak subangular blocky structure in place, but soil digs out readily into fluffy and mellow weak fine crumbs. Slightly plastic when wet. pH 4.8.

S49-Mont-18-1-5

B₂₃ 9-17"

Light yellowish-brown (10YR 6/4; yellowish-brown to brown, 10YR 5/4 to 4/3 moist) friable gravelly heavy loam. pH 5.0. Not so fluffy as two layers above. Weak medium subangular blocky structure in place, but breaks readily into fine crumbs and a few fine subangular blocky aggregates.

S49-Mont-18-1-6

B₂₄ 17-27"

Light yellowish-brown (10YR 6/4; yellowish brown, 10YR 5/4, moist) friable very gravelly light clay loam with weak fine subangular blocky structure. Slightly plastic when wet. pH 5.0. About 50 percent of gravel is about 1/4 inch and 60 percent is larger than 2mm. Soil adheres to gravel.

S49-Mont-18-1-7

B₃ 27-35"

Light yellowish-brown (10YR 6/4; yellowish brown to dark yellowish brown 10YR 5/4-4/4, moist) very gravelly friable loam. The gravel pieces are angular and flat, and consist of red, brown and gray sandstones, shales, granites, gneiss, schists, and dolomite. Many are MnO₂ coated. Gravel is easily broken with hammer. Moderate medium subangular blocky structure.

S49-Mont-18-1-8

C₁ 35-47"

Very pale brown (10YR 7/3; brown, 10YR 5/3, moist) very gravelly and stony heavy loam to clay loam with moderate fine subangular blocky structure. The aggregates are dark coated. pH 5.3.

S49-Mont-18-1-9

C₂ 47-60"

Very pale brown (10YR 7/3; brown to light yellowish brown, 10YR 5/3 to 10YR 6/4, moist) gravelly and stony clay loam till. pH 5.5. No definite structure, but digs out somewhat lumpy.

Remarks: This soil is Brown Podzolic but it has a definite tendency toward a Gray Wooded soil and does grade into a Gray Wooded or Low Humic Glei soil a short distance to the north.

Glacier County, Montana

(Brown Podzolic)

..... very gravelly loam

S49Mont 18-1-1 to 1-9

Lab. Nos. 49859 to 867

Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %						
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	VCS
3/4-0	A ₀	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0- $\frac{1}{2}$	A ₂	2.5	0.9	0.3	0.1	12.5	16.3	23	4.4	2.92	7.3	29.6	50.9	11.8	9.7	5.0	6.8	8.5
$\frac{1}{2}$ -3	B ₂₁	2.0	0.7	0.5	0.1	18.5	22.2	15	4.6	1.71	19.5	29.5	48.7	8.6	7.4	3.8	6.4	5.6
3-9	B ₂₂	0.8	0.5	0.5	0.1	17.2	19.4	11	4.8	1.10	20.5	27.8	46.9	8.8	7.2	4.1	5.9	6.6
9-17	B ₂₃	1.8	1.5	0.6	0.1	12.7	16.7	24	5.0	0.49	21.4	28.8	48.7	8.1	6.2	3.4	5.3	6.9
17-27	B ₂₄	2.5	2.0	0.4	0.1	8.6	13.6	37	5.0	0.24	18.0	20.4	37.0	8.8	10.3	6.9	10.1	8.9
27-35	B ₃₁	3.1	2.2	0.2	0.1	4.5	10.1	55	5.3	0.14	13.6	11.3	19.5	5.5	9.6	9.7	22.0	20.1
35-47	C ₁	5.3	3.7	0.3	0.1	5.0	14.4	65	5.2	0.18	19.3	21.1	36.7	9.5	10.4	6.4	9.2	8.5
47-60	C ₂	6.8	3.9	0.3	0.1	3.7	14.8	75	5.3	0.12	18.8	22.6	41.0	12.0	11.0	5.1	6.6	5.5

Unnamed series, gravelly loam--Brown Podzolic

Collectors: Ableiter, Leighty, Roberts, and Williams, July 23, 1949, 8:30 a.m. to 11:30 a.m.

Location: Glacier County, Montana, 2 1/4 miles north on Hilton sawmill road, which turns north from U. S. Highway 89, 1.8 miles west of Hudson Bay Pass west of Browning, Montana. Sample collected approximately 100 feet west of road, 2 miles north of profile S49-Mont-18-1 on same road and same ridge.

Elevation: 6,100 feet.

Relief: Nearly level high ridge top with some irregular microrelief but relatively smooth slope which is to the west.

Vegetation: Virgin stand of balsam fir, lodgepole pine, and spruce. Understory of bear grass and shrubs similar to soil S49-Mont-18-1. The trees are approximately 5 feet apart and 6 to 20 inches in diameter and 60 to 80 feet high; however, there are many open areas of bear grass and small shrubs. There are a considerable number of fallen logs; many are only partially decayed. Many of the trees, especially the fir, have galls at approximately 1 foot above the ground. The galls may be twice the diameter of the tree and 3 to 12 inches in length. The younger trees are affected more than the older trees. Good reproduction of fir trees.

Drainage: Soil appears to have adequate surface drainage and fair to good drainage through the soil. This is due to the numerous large stones and gravel. Low surface runoff, rapid infiltration and rapid permeability.

Parent material: Stony medium to heavy-textured calcareous Rocky Mountain glacial till of mixed materials, dominantly sedimentary sandstones and limestones. Same kind of parent material as at site S49-Mont-18-1, which is 2 miles south.

Biological activity: Nothing pronounced; ants and fungi, very little mycelium, no worms. Many squirrels; only evidence is their feeding on pine cones.

Climate: At weather station near Babb, 12 miles northwest of sample site and approximately 1,700 feet lower elevation, January average temperature 17.7°F., July average 60.1°F., minimum -53°F., maximum 96°F. Growing season 102 days. Average annual precipitation for 32-year period is 19.43 inches, divided as follows: January .99, February .79, March 1.14, April 1.62, May 2.40, June 3.28, July 1.95, August 1.86, September 2.14, October 1.25, November 1.00, and December 1.01. Snowfall is 88 inches. The precipitation and snowfall are probably greater where the sample was taken than at Babb.

Air temperature at 5:00 p.m. July 22 when the hole was started was 58°F. in the shade, 46°F. at 3 inches below the surface, and 40°F. at 40 inches deep. At 11:00 a.m. July 23 air temperature was 64°F., at 3 inches below surface 48°F., and 40°F. at 40 inches.

Profile: S49-Mont-18-2-1
S49-Mont-18-2-1

A₀₀ 1-3/4" (Not sampled) Loose needles and twigs. pH 5.4.

A₀ 3/4-0" Very dark brown leaf mat. pH L 5.4, F 4.7, H 4.4. Many fine rootlets and small pieces of charred wood. Thin transition to layer below. It forms a wavy line.

S49-Mont-18-2-2

A₂ 0-1" Light gray (10YR 7/2; brown, 7.5YR 5/3, moist) very friable non-plastic or very slightly plastic loam with some gravel. pH 4.7. Moderate digestion with H₂O₂. Weak fine platy structure. Many roots of 1/2" or less in diameter.

S49-Mont-18-2-3

A₃ 1-3" Fluffy (lightweight) very pale brown (10YR 7/4; yellowish-brown, 10YR 5/4, moist) friable slightly plastic weak fine granular to weak subangular blocky heavy loam. pH 4.8. Many roots. Gravel are angular.

S49-Mont-18-2-4

B₂₁ 3-7" Very pale brown (10YR 7/3; brown, 10YR 5/3, moist) friable heavy gravelly loam. pH 5.3. No shot. Coarsely laminated in place, but when dug, breaks to fine crumbs and to a few medium and fine subangular blocky aggregates. Gravel and cobbles are angular. Slightly plastic when wet.

S49-Mont-18-2-5

B₂₂ 7-11" When very dry, a very pale brown (10YR 7/3; yellowish-brown, 10YR 5/4, moist) friable heavy loam to light clay loam with weak fine to medium subangular blocky structure which broke to weak crumbs. Medium plastic. Many fine roots. Angular cobble and gravel. Slight staining on face of aggregates. pH 5.4.

S49-Mont-18-2-6

B₃ 11-22" Similar in color to layer above. Friable clay loam with many gravel. Soil adheres to gravel and stones. Weak medium to fine subangular blocky structure. Moderately plastic when wet. pH 5.4.

S49-Mont-18-2-7

C₁₁ 22-36" Very pale brown (10YR 7/3; yellowish-brown, 10YR 5/4, moist) sticky plastic, very stony silty clay loam or silty clay. Friable to firm weak fine nuciform aggregates. pH 5.6. Many roots.

C₁₂ 36-40" Transition not sampled. Stony and gravelly noncalcareous till. pH varied from 6.2 at 36", 6.8 at 38", to 7.8 at 38 1/2".

S49-Mont-18-2-8

C₂ 40-47" White or light gray (10YR 8/2 or 10YR 7/2; brown, 10YR 5/3, moist) uniformly moderately calcareous, slightly to moderately plastic gravelly and stony clay loam. pH 8.2. Strong effervescence with H₂O₂. Considerable limestone rock begins at 40 inches. Many stones and gravel pieces of various sizes, shapes, and color (green to red).

Remarks: Strong Brown Podzolic soil, with possible tendency toward Gray Wooded soil. Similar parent material as S49-Mont-18-2 except more limestone rock below 40 inches. This profile is exceedingly well drained, especially in the lower layers owing to excessive amount of stone and gravel. In one way the profile is young, owing to the excessive amount of stones and gravel. Below 22 inches is one big stone on another.

Sample in field when wet and dry was slightly browner and less yellow in color than the sample after it had become very dry in the office. The colors above are those determined in the office.

. . . gravelly heavy loam Glacier County, Montana (Brown Podzolic)

S49Mont 18-2-1 to 2-8			Lab. Nos. 49868 to 875						(Part of G.S.G. study)									
Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
3/4-0	A ₀	--	--	--	--	--	--	--	4.6	--	--	--	--	--	--	--	--	--
0-1	A ₂	1.8	1.0	0.5	0.1	13.2	16.6	20	4.0	3.56	9.1	24.3	43.3	15.1	15.8	4.9	5.0	6.8
1-3	A ₃	3.1	1.3	0.6	0.1	14.6	19.7	26	4.6	1.53	19.4	24.8	38.6	10.4	11.3	5.7	7.8	6.8
3-7	B ₂₁	2.4	1.5	0.6	0.1	18.0	22.6	20	4.4	1.19	25.0	23.3	38.6	9.1	9.8	4.9	6.7	5.9
7-11	B ₂₂	3.4	1.7	0.4	0.1	17.2	22.8	24	4.8	0.99	25.8	23.0	39.5	9.2	9.3	4.7	6.2	5.3
11-22	B ₃	6.4	2.9	0.2	0.1	12.9	22.5	43	4.9	0.42	29.3	28.1	44.9	6.1	5.2	3.6	5.3	5.6
22-36	C ₁	9.3	3.7	0.3	0.1	11.2	24.6	54	4.6	0.37	31.1	32.3	47.3	4.8	4.6	3.1	4.7	4.4
40-47	C ₃	21.3	1.5	0.2	0.1	0.0	23.1	100	7.7	0.24	20.4	28.1	43.0	7.8	9.0	5.4	7.7	6.7

Unnamed series, gravelly loam--Brown Forest

Collectors: Ableiter, Leighty, Roberts, and Williams, July 23, 1949, 11:30 a.m. to 3:00 p.m.

Location: Glacier County, Montana, near Hudson Bay-Missouri Divide, 4.2 miles north of U. S. Highway 89 on Hilton sawmill road, which turns north from U. S. Highway 89 1.8 miles west of Hudson Bay Divide. Sample taken 30 feet east of road under dense clump of balsam fir trees. No ground cover; 1/2 mile north is good grass land. This sample site is about 2 miles north of site of sample S49-Mont-18-2, a gravelly heavy loam, Brown Podzolic soil.

Elevation: 5,900 feet.

Relief: A ridge or plateau ranging from 5,800 to 6,150 feet elevation, fairly level. Approximately 2 to 4 percent slope which slopes to north and west.

Vegetation: Dominantly balsam fir and lodgepole pine, with a few spruce. Virgin timber; trees range widely in density, in places 2 feet apart and in other places 10 to 13 feet apart. Many trees 100 years old, 12 inches in diameter; a few 300 years old, 20 inches in diameter. Some fallen trees but not many; no stumps. Many of the trees are moss covered, and there is a noticeable amount of fir reproduction. In more open spaces there are white barked pine and weeds and grass. No bear grass.

Drainage: Internal and external drainage very good. Has appearance of being a dry to very dry site. Low surface runoff, rapid infiltration and rapid permeability.

Parent material: Stony medium-textured calcareous glacial till, with a mixture of Belt rocks and a high percentage of limestone of several kinds; rocks angular, some 3 feet in diameter. Similar parent material as that at the two sites of the Brown Podzolic soil collected a few miles south on same road.

Biological activity: The leaf mat has a very high percentage of fungi mycelia; did not detect any insects or other visible biological life.

Climate: At the weather station near Babb, approximately 10 miles northwest of sample site and about 1,500 feet lower elevation, January average temperature 17.7°, July average 60.1°, minimum 53°, maximum 96°F. Growing season 102 days. Average annual precipitation for 32-year period is 19.43 inches, divided as follows: January .99, February .79, March 1.14, April 1.62, May 2.40, June 3.28, July 1.95, August 1.86, September 2.14, October 1.25, November 1.00, and December 1.01. Snowfall is 88 inches. The precipitation and snowfall are probably greater where the sample was taken than at Babb. The precipitation and temperature are probably about the same at this site as at the sample sites of Brown Podzolic soils collected on this same road but to the south, except that the wind is probably stronger here and more continuous. Air temperature at sample site at noon 64°F., at 3 inches in soil 46°F., and at a depth of 30 inches 40°F.

Profile: S49-Mont-18-3

S49-Mont-18-3-1

A₀₀ 2 1/2-2" (Not sampled) Loose layer of needles and twigs.

A₀ 2-0" Dark brown (nearly black when moist) fluffy granular loose mat of decomposed fir needles with a large amount of fungi mycelia contains the highest amount of any sample collected on this study, pH ranges from 5.0 to 6.1. The mycelia have the low pH. Abrupt change to layer of A₁ below. Some angular small gravel of sandstone.

S49-Mont-18-3-2

A₁ 0-7" Dark brown (10YR 4/3; dark grayish-brown, 10YR 4/2, moist) granular to weak crumb, friable, slightly plastic gravelly loam. Slight digestion

with H₂O₂. pH 4.8. Boundary wavy with layer below. Appeared to have low bulk density.

S49-Mont-18-3-3

B₂ 7-14" Pale brown (10YR 6/3; brown 10YR 4/3, moist) moderate medium subangular blocky to blocky gravelly clay loam. Slight digestion with H₂O₂. pH 4.8. Soil is friable and aggregates break easily to soft fine granules or crumbs. Moderately plastic when wet. Roots plentiful. Many weathered stones of light weight.

S49-Mont-18-3-4

B₃ 14-25" Very pale brown (10YR 7/3; brown, 10YR 4/3, moist) friable weak medium subangular blocky gravelly light clay loam. When touched, aggregates break to fine crumbs. Slightly plastic. Many stones. Gravel is angular. Roots less plentiful than in layer above. pH 5.6. No reaction with H₂O₂.

S49-Mont-18-3-5

C₁ 25-33" Very pale brown (10YR 8/3; brown, 10YR 5/3, moist) friable gravelly and stony clay loam. Weak subangular blocky aggregates break easily into fine crumbs. Slightly plastic. Many limestone rocks, rocks lime-coated on under side. pH ranges from 6.8 in upper part to 7.5 in lower part. pH 5.6 at 20 inches, 6.8 at 26, and 6.8 at 28.

S49-Mont-18-3-6

C₂ 33-40" Light gray (10YR 7/2; brown, 10YR 5/3, moist) friable very gravelly and stony clay loam to silty clay loam; calcareous. pH 8.2. Vigorous effervescence, no digestion with H₂O₂. Definitely sticky but only slightly plastic. Dug out readily into fine subangular blocky and granular aggregates. It appears that these rocks weather to fairly heavy clay loams or clays.

Remarks: This profile is characteristic of one kind of Brown Forest soil of the west. If it were not for the timber cover it would readily be classified as a Prairie soil from calcareous material. It is possible that this site was in grass 300 or more years ago. Approximately 1/2 mile north of the same ridge at the same elevation grass is the dominant vegetation, with some shrubs and a few white bark pines and lodgepole pines scattered in clusters of 2 or 3, and many alone. The soil under the grass vegetation is darker, black (10YR 2/2), and more sooty than under the trees. It has the appearance of higher organic matter, nearly muck on the surface inch or two. It is not so acid as the soil under the trees. The leaf mat under the trees where sample was collected is uncommonly thick for Brown Forest soils of the West.

The boundary between the Brown Podzolic and Brown Forest is abrupt and distinct. The kind of vegetation is the same but the general appearance is different. The color of the soil in the road is very distinct, and weeds are more abundant in Brown Forest soils. Many of the trees in the Brown Forest area have the general appearance of growing in grass land, branching profusely from the ground.

This profile does not show any evidence of Podzolization so characteristic of the Brown Podzolic and Gray Wooded soils.

In grass land area the air temperature was 64°F., at 3 inches in the grass 58°F., and at 3 inches under shade of a group of 3 lodgepole pines 48°F. In other words, the soil under the trees is approximately 10°F. colder during the day than the soils under grass.

... gravelly loam

Glacier County, Montana

(Brown Forest)

S49Mont 18-3-1 to 3-6

Lab. Nos. 49876 to 881

Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %						
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	VCS
2-0	A ₀	---	---	---	---	---	---	---	5.4	---	---	---	---	---	---	---	---	---
0-7	A ₁	6.4	1.6	0.4	0.1	22.8	31.3	27	4.8	3.99	20.7	29.8	49.2	7.9	6.4	3.3	5.9	6.6
7-14	B ₂	8.5	1.1	0.2	0.1	11.4	21.3	46	5.3	0.83	19.5	30.2	51.6	7.8	4.6	2.7	5.5	8.3
14-25	B ₃	11.5	0.9	0.1	0.1	4.3	16.9	74	6.1	0.49	17.7	27.1	45.0	8.8	6.8	4.2	8.6	8.9
25-33	C ₁	20.2	1.5	0.1	0.1	0.8	22.7	96	7.6	0.43	16.0	27.0	47.0	8.0	6.4	4.1	8.4	10.1
33-40	C ₂	22.3	1.7	0.1	0.1	0.0	24.2	100	8.0	0.25	17.2	29.6	50.9	7.5	6.1	3.6	6.8	7.9

Waits gravelly loam¹--Brown Pozolic

Collectors: Ableiter, Gieseke, Leighty, Roberts, and Williams, July 11, 1949, 2:00 to 7:00 p.m. Cloudy, some showers.

Location: Flathead County, Montana, NW 1/4 SE 1/4 Sec. 4, T. 32 N., R. 23 W. About 2.5 miles northeast of Olney, Montana, on north side of east-west Upper Whitefish Lake road, east of U. S. Highway #93. Approximately 100 yards northwest of corral and cattle load chute.

Elevation: 3,400 feet.

Relief: Undulating to rolling with considerable irregular microrelief of swells and sags. Smooth at sample site. A large hay meadow lies just to the north.

Vegetation: Cut-over area of larch, balsam fir, lodgepole pine, a few birch with an under-story of Oregon grape, kinnikinnick, gooseberries, wild strawberries, bracken fern, with some clover and grass in open areas. Sample collected in shaded area, few shrubs. Many dead and partially decayed logs.

Drainage: Well drained soil; surface and internal drainage appear to be good. Soil appears to have rapid infiltration and rapid or moderately rapid permeability. No evidence of mottling or restricted drainage.

Parent material: Gray compact calcareous till; many green, gray and purple rocks of Belt series; chiefly argillites, quartzites, limestones. Rocks not coated with clays or iron.

Biological activity: Very little activity; a few ants in leaf mat and many logs destroyed by fungi and ants.

Climate: At Fortine, Lincoln County, Montana, which is about 25 miles northwest of sample site and approximately 425 feet lower elevation, the January average temperature is 18.8, July average 62.8°F. Growing season is 102 days. Annual precipitation for period of 33 years is 17.43 inches, divided as follows: January 1.57, February 1.16, March 1.20, April 1.03, May 1.69, June 2.28, July 1.22, August 1.37, September 1.47, October 1.30, November 1.54, and December 1.60. The average annual snowfall is 54.7 inches. The average snowfall and precipitation are slightly greater where sample was taken than at Fortine.

Air temperature at sample site 68°F., soil at 6 inches 54°F., and 48°F. at 30 inches.

Profile: S49-Mont-15-1

S49-Mont-15-1-1

A₀ 1-0" Dark grayish-brown (10YR 4/2; very dark gray, 10YR 3/1, moist) fluffy mat of decomposed leaves, roots. pH 4.4. Rests abruptly on gray A₂. Has some irregularly shaped gravel.

S49-Mont-15-1-2

A₂ 0-1/4" White (10YR 8/1; grayish-brown, 10YR 5/2, moist) nonplastic loam. Has tendency to be coarsely platy; some fine granules or weak crumbs. Some gravel. Moderate digestion with H₂O₂. pH 4.7. Abrupt change to layer below. Layer is variable in thickness and uneven. Many roots.

S49-Mont-15-1-3

B₂₁ 1/4-1 3/4" Brown (10YR 5/3; dark brown, 7.5YR 4/2, moist) slightly plastic gravelly loam with weak fine crumb structure. pH 5.3. Moderate digestion with H₂O₂. This layer appears to be light weight and fluffy. There are many roots.

¹ An area 12" x 12" x 3" weighs 18 pounds, with 4 pounds gravel larger than 1/4-inch screen. No shot but many small rounded gravel.

S49-Mont-15-1-4

B ₂₂	1-3/4-5"	Very pale brown (10YR 7/4; yellowish-brown, 10YR 5/4, moist) slightly plastic flutty gravelly loam with weak crumb structure. pH 5.8. Slight digestion with H ₂ O ₂ .
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S49-Mont-15-1-5

B ₂₃	5-11"	Same color and texture as layer above. pH 6.6. Slight digestion with H ₂ O ₂ . Abrupt change to till below but very irregular line.
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S49-Mont-15-1-6

C ₁	11-30"	Light gray (10YR 7/1; light brownish-gray, 10YR 6/2, moist) gravelly and stony plastic loam. This is compact leached till. pH 6.4. Slight reaction with H ₂ O ₂ . It digs out in large irregular lumps.
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S49-Mont-15-1-7

C ₂	30-44"	Similar in color and consistence to layer above. Very slightly weathered gray stony loam till. pH ranges from 6.5 in upper part to 6.7 in lower part.
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In more sloping area 200 yards to the east till highly calcareous, even on material on upturned tree roots.

Remarks: This soil appears to be strongly developed Brown Podzolic, grading toward a Podzol. It appears to be about as far advanced as Alderwood loam, sample S49-Wn-31-1. Most of roots are in upper 5 inches.

Flathead County, Montana

Waits gravelly loam

Lab. Nos. 49882 to 888

S49Mont 15-1-1 to 1-7

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1-0	A ₀	---	---	---	---	---	---	--	4.6	--	--	--	--	--	--	--	--	--
0-1/4	A ₂	4.3	1.0	0.3	0.1	6.5	12.2	47	5.1	1.78	6.3	38.6	58.1	7.8	5.5	3.8	8.3	10.2
1/4-1 3/4	B ₂₁	2.1	0.5	0.4	0.1	21.8	24.9	12	5.0	1.85	9.5	35.6	55.1	9.3	5.7	3.7	7.9	8.8
1 3/4-5	B ₂₂	2.0	0.5	0.4	0.1	15.3	18.3	16	5.4	1.17	5.4	35.4	56.0	9.6	6.5	4.1	8.3	8.9
5-11	B ₂₃	2.5	0.4	0.3	0.1	12.7	16.0	21	5.5	1.15	6.4	34.8	54.6	10.1	6.9	4.4	8.9	8.7
11-30	C ₁	2.8	0.6	0.1	0.1	1.8	5.4	66	5.9	0.17	7.8	31.4	49.0	8.6	8.7	5.4	10.2	10.3
30-44	C ₂	4.2	1.0	0.1	0.1	1.3	6.7	80	6.2	0.07	7.0	17.4	23.9	3.8	6.7	7.8	23.3	27.5

Waits gravelly loam--Brown Podzolic

Collectors: Ableiter, Leighty, Gieseke, Roberts, and Williams, July 12, 1949, 8:30 a.m. to 1:00 p.m. Clear and warm.

Location: Flathead County, Montana, SW 1/4 SW 1/4 SW 1/4 Sec. 5, T. 32N., R. 23 W., or about 250 feet northeast of section corner of sections 5, 6, 7, and 8 on south side of east-west road. About 2 miles northeast of Olney, Montana. This sample is approximately 1 mile west of sample site S49-Mont-15-1, Waits gravelly loam.

Elevation: 3,200 feet.

Relief: Smooth nearly level to gently sloping, 3 percent slope. Near crest of ridge with rather steep slope to the south and west. Soil very shallow. Irregular micro-relief made it difficult to locate sample site.

Vegetation: Open stand of balsam fir, larch, lodgepole pine, and Douglas fir. Not very much understory or moss on ground. In places roses, kinnikinnick and prostrate juniper. Groves or clumps of trees 8 to 12 inches in diameter and 6 to 8 feet apart. One balsam fir 200 years old, 24 inches in diameter. Very little young reproduction.

Drainage: Well drained soil; surface and internal drainage appear to be good. Soil appears to have rapid infiltration and rapid or moderately rapid permeability. No evidence of mottling or restricted drainage.

Parent material: Gray compact calcareous till consists of gray, green, and purple sandstones, schists, and quartzites of Belt series.

Biological activity: Very little noticeable biological activity; a few ants.

Climate: At Fortine, Lincoln County, Montana, which is about 25 miles northwest of sample site and approximately 425 feet lower elevation, the January average temperature is 18.8° F., the July average 62.8° F. Growing season is 102 days. Annual precipitation for period of 33 years is 17.43 inches, divided as follows: January 1.57, February 1.16, March 1.20, April 1.03, May 1.69, June 2.28, July 1.22, August 1.37, September 1.47, October 1.30, November 1.54, and December 1.60. The average annual snowfall is 54.7. The average snowfall and precipitation is slightly greater where sample was taken than at Fortine. Air temperature at sample site when sample was collected 60° F., 54° F. at 4 inches below the surface, and 49° F. at 40 inches below surface.

Profile: S49-Mont-15-2

S49-Mont-15-2-1

A ₀₀ and A ₀	1-0"	Litter of fir needles, twigs, bits of bark over a thin layer of decomposed needles and wood. Ground fires evidently have destroyed much of this layer. pH 4.6. Very little moss.
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S49-Mont-15-2-2

A ₂	0-1/4"	Light gray (10YR 7/1; grayish, brown, 10YR 5/2, moist) moderate medium platy very fine sandy loam, which on disturbance breaks into weak fine crumbs. Nonplastic. Brown stains occur along the root channels, which, in general, are small. Boundary to layer below is sharp, but the surface plane is very uneven and wavy. pH 5.0. Strong digestion with H ₂ O ₂ .
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S49-Mont-15-2-3

B ₂	1/4-1 1/2"	Yellowish brown (10YR 5/6; brown, 7.5YR 4/4, moist) firm, slightly plastic silt loam. Broke readily into a fluffy mass of weak fine crumbs. pH 5.2. Moderate digestion with H ₂ O ₂ .
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S49-Mont-15-2-4

B₃ 1 1/2-9" Light yellowish-brown (10YR 6/4; yellowish-brown, 10YR 5/4, moist) fluffy slightly plastic silt loam with weak crumb structure. pH 5.0. Strong digestion with H₂O₂.

S49-Mont-15-2-5

C₁₁ 9-12" White (10YR 8/1; light brownish-gray, 10YR 6/2, moist) hard compact noncalcareous slightly plastic light clay loam; some gravel. pH 6.7. Very slight reaction with H₂O₂.

S49-Mont-15-2-6

C₁₂ 12-25" Similar in color and consistence to layer above. A gray siliceous gravelly heavy loam. pH 6.6. Very slight reaction with H₂O₂.

C₁₃ 25-31" Transition not sampled. pH 6.8.

S49-Mont-15-2-7

C₁₄ 31-42" Light gray (10YR 7/2; light brownish-gray, 10YR 6/2, moist) slightly variegated with brown or yellowish brown friable slightly plastic gravelly loam. pH 6.9. Very slight reaction with H₂O₂.

C₁₅ 42-48" Transition not sampled. Lime coatings on rocks, heavy loam texture.

S49-Mont-15-2-8

C₂ 48-55" White (10YR 8/1) Calcareous till, which is massive in place and digs out into irregular lumps.

Remarks: This profile is a good duplicate of sample S49-Mont-15-1. Both soils appear to be within the range of Brown Podzolic soils but they are grading close to Podzols. Both samples appear to be very well drained and both are shallow, due in part to the excessive amount of stones, gravel, and cobbles.

Waits gravelly loam

Flathead County, Montana

(Brown Podzolic)

S49Mont 15-2-1 to 2-8

Lab. Nos. 49889 to 896

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	OS	VCS
1-0	A ₀₀₀ 0	--	--	--	--	--	--	--	4.9	--	--	--	--	--	--	--	--	--
0-1/4	A ₂	2.8	0.8	0.5	0.1	7.8	12.0	35	4.8	1.35	5.8	52.5	75.5	8.9	3.4	1.5	2.6	2.3
1/4-1 1/2	B ₂₁	2.3	0.7	0.6	0.1	23.1	26.8	14	5.4	1.92	8.7	43.8	65.2	9.6	3.4	1.9	5.2	6.0
1 1/2-9	B ₂₂	3.0	0.7	0.5	<0.1	15.4	19.6	21	5.8	1.22	4.4	41.6	66.5	10.9	4.4	2.3	5.1	6.4
9-12	C ₁	2.0	0.5	0.1	<0.1	1.5	4.1	63	6.1	0.17	9.1	43.2	62.4	6.9	6.4	3.7	5.9	5.6
12-25	C ₁₂	2.1	0.6	0.1	<0.1	1.6	4.4	64	6.1	0.11	10.1	42.5	61.1	6.7	6.3	3.6	6.2	6.0
31-42	C ₁₃	5.7	1.6	0.1	0.1	1.6	9.1	82	6.4	0.15	15.0	36.5	54.3	7.0	6.6	3.8	6.4	6.9
48-55	C ₂	15.9	0.9	0.1	0.1	0.0	17.0	100	7.9	0.05	11.0	35.1	53.5	7.8	7.7	4.6	7.7	7.7

Whitefish cobbly loam--Gray Wooded

Collectors: Ableiter, Leighty, Roberts, and Williams, July 24, 1949, 8:30 to 10:00 a.m. and 4:00 p.m. to 8:00 p.m. Rain at 10:00 a.m.

Location: Flathead County, Montana, 1.6 miles west of Whitefish River bridge at Whitefish, Montana, and .2 mile southwest. Sample collected on east-facing slope about 200 feet west of north-south road.

Elevation: 3,200 feet.

Relief: Sloping, 18 percent slope. Rather smooth slope but minor bumps and depressions. A few rocks exposed.

Vegetation: Burned-over land. Old stumps 24 inches in diameter 20 to 30 feet apart. Second growth mixed stand of balsam poplar, larch, white and yellow birch, red maple, balsam fir, few aspen, alder, and undergrowth of service berry, Oregon grape, and some ferns. Lots of yellow and white sweet clover along road. Second growth trees range from 2 to 8 inches in diameter and are thick, but sunlight strikes most of the soil. Sample site was barren of undergrowth. Fungi, algae, or lichens on trees; some moss.

Drainage: External drainage good. Drainage through soil slow owing to poor structure, but no evidence of mottling.

Parent material: Calcareous, medium heavy-textured glacial till of Belt formation. Sandstone, limestone, argillite, and greenstone, angular and rounded. Till has a gray to white solid color.

Biological activity: Nothing noticeable; fungi on old logs; not much fallen timber.

Climate: At Columbia Falls, 11 or 12 miles east of the sample site and approximately 100 feet lower elevation, the January average temperature is 22.3, the July average is 65.8° F. The average growing season is 99 days. Precipitation for 39 year period is 20.65 inches, divided as follows: January 1.93, February 1.35, March 1.09, April 1.26, May 2.40, June 2.72, July 1.37, August 1.42, September 1.76, October 1.52, November 1.73, and December 2.10. These data show a very even distribution. The annual snowfall is approximately 70 inches. At 9:00 a.m. at sample site air temperature was 64° F., at 3 inches below surface 54° F. At 5:00 p.m. air temperature 60° F., at 3 inches below surface 54° F., and 50° F. at 35 inches.

Profile: S49-Mont-15-3

S49-Mont-15-3-1

A ₀	1/4-0"	Larch leaf mat, brown, acid, and fibrous. Ranges from 1/8 inch to 1 inch. Abrupt change to layer below.
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S49-Mont-15-3-2

A ₂₁	0-1"	Light gray (10YR 8/1) very fine sandy loam approaching a silt loam with many iron and MnO ₂ stains and (ortstein) of a strong brown color. When crushed and wet, the color is dark brown (10YR 4/3). Tendency to lamination but not distinct; nonplastic. This layer is uneven in depth, ranging from 1/4 to 2 1/2 inches within a distance of 1 inch. In places it has few concretions, probably MnO ₂ . Many pieces of angular gravel, most of which are coated with MnO ₂ on underside. Some coated on upper side. Gradual change to layer below. pH 6.8. Strong digestion with H ₂ O ₂ . Many 1/4-inch horizontal roots.
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S49-Mont-15-3-3

A₂₂ 1-8" Very pale brown (10YR 7/3) nonplastic loam or silt loam, but probably close to a very fine sandy loam. (Difficult to decide texture). No distinct structure, but one gets an impression of weak laminations. Soil is hard, but brittle, and of light weight. It is vesicular and siliceous. When cut with knife there are many small MnO₂ concretions, pH 6.8. Strong digestion with H₂O₂. Grades into layer below. Although slightly sticky, the soil feels lifeless.

S49-Mont-15-3-4

A₂₃ 8-13" Light gray (10YR 8/1) brittle, lifeless, very slightly plastic, very gravelly loam or silt loam. We guess it is close to the loam, silt loam, very fine sandy loam boundary. When wet it is brownish gray (10YR 6/2). No apparent structure, and hard when dry. This layer appears to be a mixture of small gravel embedded in a matrix of earthy material; very vesicular. Abrupt change to layer below, but line is wavy, pH 6.8. Slight effervescence, slight digestion with H₂O₂. Many green rocks and gravel. They are coated with colloid on top but are clean on underside.

S49-Mont-15-3-5

B₂ 13-22" Yellowish-brown (10YR 5/4) slightly plastic moderately stiff clay loam which is light yellowish-brown (10YR 6/4) when crushed and brown (10YR 5/3) when wet. The structure units are irregular and large and coated or stained with organic matter. Many roots along cleavage planes. This layer has tendency to develop subangular blocky structure but is not distinct. The material is somewhat vesicular and brittle and less weathered than layer above. Under lens, many kinds of minerals seen in soil. Noncalcareous; pH 7.5. No digestion, but slight effervescence with H₂O₂.

S49-Mont-15-3-6

22-22 1/2" A brown calcareous root mat consisting of many fine roots which is spongy, continuous, and changes abruptly to layers above and below. It follows the slope. No digestion with H₂O₂. Dark brown when wet.

S49-Mont-15-3-7

C 22 1/2-36" Uniformly calcareous white (10YR 8/2; light gray, 10YR 7/2, moist) slightly plastic heavy loam to silty clay loam; more friable than layer above. pH 8.2. No reaction with H₂O₂. Many stones and cobbles.

Remarks: This is a Modal Gray Wooded Soil developed from calcareous till. The root mat at 22 inches is very pronounced. It definitely occurs at the break between the calcareous and noncalcareous material.

S49Mont 15-3-1 to 3-6		Lab. Nos. 49897 to 902																
Depth Inches	Horizon	M.E./100 Grams Soil						% B SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-1	A ₂₁	5.9	1.0	0.6	<0.1	3.8	11.3	67	6.3	1.11	7.4	43.2	66.4	9.6	5.5	2.5	4.1	4.5
1-8	A ₂₂	8.2	1.2	0.7	0.1	3.8	14.0	73	6.6	0.87	11.8	39.8	62.1	9.6	5.8	2.8	4.4	3.5
8-13	A ₂₃	5.9	1.1	0.3	0.1	1.3	8.7	85	7.0	0.33	10.0	37.2	57.6	9.4	7.2	3.7	5.9	6.2
13-22	B ₂	11.6	3.0	0.5	0.1	1.9	17.1	89	7.1	0.51	24.6	33.4	50.3	7.4	5.9	3.0	4.4	4.4
22-22-1/2	--	56.4	11.4	0.5	0.5	3.0	71.8	96	7.5	8.8	21.7	32.9	49.1	9.0	8.2	3.4	4.8	3.8
22-1/2-36	C	19.5	1.8	0.1	0.2	0.0	21.6	100	8.0	0.40	11.4	39.3	59.5	8.4	6.5	3.4	5.3	5.5

Whitefish gravelly loam--Gray Wooded

Collectors: Ableiter, Leighty, Roberts, and Williams, July 25, 1949. 8:00 a.m.

Location: Flathead County, Montana, SE 1/4 SW 1/4 SE 1/4 Sec. 12, T. 30 N., R. 22 W., or 2 3/4 miles south of Whitefish, Montana, on U. S. Highway 93. Sample collected by a large fir tree on west side of road approximately 50 feet from road bank.

Elevation: Approximately 3,160 feet.

Relief: 3 to 5 percent, irregular and undulating. Sample site on ridge.

Vegetation: Dominantly Douglas fir but some larch, balsam fir, lodgepole pine, birch, spruce, and alder, with undergrowth of roses, service berry, Oregon grape, and some creeping Juniper and kinnikinnick. Forest is open; some trees 8 or more feet apart, 7 inches in diameter, 25 years old. Some 10 to 12 inches in diameter, one 75-year old Douglas fir, 16 inches in diameter. The big old trees were about 20 feet apart. Very little moss on the ground or on the trees. Considerable grass in the open spaces; some fallen timber; logs honey-combed by ants.

Drainage: External drainage good; drainage through the soil slow because of poor structure.

Parent material: Medium-textured calcareous glacial till of about Wisconsin age with dominantly rounded sedimentary rocks. Most of them are lime coated at depths below about 20 inches. Dolomite, argillite, and greenstone appear to be most common.

Biological activity: Many ants and some centipedes. Considerable mycelia in leaf mat but not nearly the amount as in the Brown Forest soils. Considerable fungi under logs.

Climate: At Columbia Falls, 10 miles east and at approximately 100 feet lower elevation than sample site, the January average temperature is 22.3° F., the July average is 65.8° F. The average growing season is 99 days. Precipitation for 39-year period is 20.65 inches, divided as follows: January 1.93, February 1.35, March 1.09, April 1.26, May 2.40, June 2.72, July 1.37, August 1.42, September 1.76, October 1.52, November 1.73, and December 2.10. These data show a very even distribution. The annual snowfall is approximately 70 inches. Air temperature at sample site at 8:00 a.m. July 25 58° F., at 3 inches in soil 48° F., and at 31 inches 48° F.

Profile: S49-Mont-15-4

S49-Mont-15-4-1

A ₀₀	1-0"	A loose litter of needles, twigs, and leaves lies over nearly black partly decomposed and decomposed Douglas fir needles which form a felty mat. pH 6.4. This layer may be described to consist of 1/8 inch loose fir needles, pH 5.8, 1/2 inch F layer and 1/2 inch H layer. Many roots lie along the lower boundary.
A ₀	and	

S49-Mont-15-4-2

A ₂₁	0-1"	Light gray (10YR 7/1; crushed, light brownish-gray 10YR 6/2; wet and crushed, grayish-brown, 10YR 5/2; wet uncrushed dark grayish-brown, 10YR 4/2) weak platy nonplastic silt loam or very fine sandy loam that breaks easily into fine crumbs. Many small (1 mm. or less) black and very dark brown soft angular and rounded concretions, high in MnO ₂ . pH 6.0. Strong digestion with H ₂ O ₂ .
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S49-Mont-15-4-3

A ₂₂	1-2"	Light gray (10YR 7/2; grayish brown to brown 10YR 5/2 to 5/3 moist) silt loam which appears to be close to a very sandy loam. Platy structure more definite than in layer above; material crumbles readily to fine crumbs. This layer sampled separately because it appears slightly browner than layer above or below and suggests a slight accumulation of iron.
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S49-Mont-15-4-4

A₂₃ 2-8" White (10YR 8/2 to 10YR 8/1) distinctly fine platy silt loam; vesicular, with holes 1/2 mm. to 2 mm. in diameter, some oblong shaped. Soil material fits closely around large sand grains and small gravel. Soil when crushed is light gray (10YR 7/2), and is pale brown to grayish-brown (10YR 6/3 to 5/2) when wet. Many concretions. Soil not fluffy, but breaks readily to medium crumbs. Many roots and small pieces of gravel. Very slightly sticky which suggests slightly more clay than in layer above.

S49-Mont-15-4-5

A₃ 8-13" Light gray (10YR 7/1; light brownish-gray, 10YR 6/2 moist; brown, 10YR 5/3 when wet and crushed) silt loam with no distinct structure although there is a suggestion of subangular blocky aggregates. Appears massive in place, but digs out into clods which crumble in hand to fine crumbs. The moist clods have a marbled brown and gray appearance in cross section and are somewhat vesicular. Very slightly sticky and very slightly plastic to nonplastic. Many small bits of gravel and rock. Some fine roots. pH at 13" is 6.6. Appears to contain small concretions of Mn or Fe.

S49-Mont-15-4-6

B₂ 13-19" Very pale brown (10YR 7/3; brown, 10YR 5/3, moist; dark brown to brown, 10YR 4/3 to 5/3, when wet and crushed) heavy silt loam to light silty clay loam. Somewhat sticky and slightly plastic (will form a weak ribbon between the fingers). Digs out into large irregular firm clods that are brittle and slightly vesicular. In cross section they show a marbled pattern of gray, light grayish-brown, yellowish-brown and dark brown. Very few vesicles. Fine dark brown rootlets. pH of 7.2 at 16". Slight effervescence with H₂O₂.

S49-Mont-15-4-7

-- 19-19 1/2" A brown calcareous mat of roots which in general is continuous. pH is 8.1.

S49-Mont-15-4-8

C₁ 19 1/2-32" Marbled light gray (10YR 7/1) gray, and yellow, slightly plastic light silty clay loam. Light brownish-gray (10YR 6/2) when wet and crushed. No distinct structural units. Many gravel and bits of yellow weathered rock. A considerable number of dead roots and rootlets which give a brown stain to the soil material. Strong effervescence with HCl. pH 8.5. No reaction with H₂O₂.

S49-Mont-15-4-9

C₂ 32-40" Nearly white (10YR 8/2 to 10YR 7/1 and 2.5YR 8/4) brittle silt loam; very slightly plastic; calcareous; pH 8.4. No distinct structure. Gravel is coated with lime; some is decomposed. pH 8.3. Roots occur in local masses, and adjacent material is commonly stained with yellow or brown.

Remarks: The root mat probably marks the depth of water penetration rather than the presence of a layer difficult for roots to penetrate, as in the Alderwood series. The high lime content just below the root mat may, however, prevent root expansion. Some of the roots, 1/4 to nearly 1/2 inch in diameter, grew perpendicular from a depth of 13 inches to the leaf mat layer 19 inches, where they immediately branched horizontally into numerous small roots.

The gravel pieces from 0 to 13 inches in depth are dominantly coated with MnO₂, those from 13 to 20 inches appear to be largely coated with iron oxide, and those below 20 inches are coated with lime.

Flathead County, Montana

Whitefish gravelly loam

(Gray Wooded)

S49Mont 15-4-1 to 4-9 Lab. Nos. 49903 to 911

Depth Inches	Horizon	M.E./100 Grams Soil							pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+	% B. SAT			Clay	III	USDA Silt	VFS	FS	MS	CS	VGS
1-0	A ₀₀ , 0	--	--	--	--	--	--	--	6.0	--	--	--	--	--	--	--	--	
0-1	A ₂₁	3.7	0.9	0.2	<0.1	4.6	9.4	51	5.8	1.18	6.2	40.2	64.9	10.0	6.4	3.0	4.6	4.9
1-2	A ₂₂	2.3	0.7	0.2	<0.1	6.1	9.3	34	5.0	0.77	7.9	40.2	65.2	10.4	6.2	2.9	4.0	3.4
2-8	A ₂₃	2.9	0.8	0.3	<0.1	6.3	10.3	39	5.1	0.70	9.0	38.8	63.5	10.2	6.1	2.8	4.0	4.4
8-13	A ₃	4.8	1.0	0.2	<0.1	5.6	11.6	52	5.4	0.64	9.4	37.4	62.0	10.4	6.4	2.9	4.5	4.4
13-19	B ₂	11.4	1.5	0.4	0.1	2.0	15.4	87	6.8	0.67	12.9	40.5	63.4	9.2	5.0	2.4	3.6	3.5
19-19 1/2	--	32.2	2.0	1.0	0.6	0.0	35.8	100	7.1	2.58	13.8	38.9	61.2	8.2	5.5	2.8	4.2	4.3
19 1/2-32	C ₁	20.3	0.5	0.3	0.3	0.0	21.4	100	7.8	0.44	9.8	39.1	63.9	8.5	5.5	2.8	4.4	5.1
32-40	C ₂	20.4	0.9	0.2	0.0	0.0	21.7	100	8.1	0.40	11.4	39.8	63.6	8.5	5.2	2.8	4.2	4.3

Pend Oreille loam¹--Brown Podzolic

Collectors: Ableiter, Baker, Gieseke, Leighty, Roberts, and Williams. Sample collected July 6, 1949.

Location: Bonner County, Idaho, NE 1/4 NW 1/4 NE 1/4 Sec. 5, T. 56 N., R. 4 W., 4 1/2 miles northeast of the town of Priest River, Idaho, .6 miles south of a side road to the east. Sample taken on the west side of a north-south road under dense woods about 50 feet west of road. (About a 5-acre cleared field is across the road to the east.)

Elevation: 2,700 feet.

Relief: In general vicinity the relief is morainic and rolling. The sample site was nearly level, with irregular microrelief caused by fallen trees and decayed logs. The sample was collected on top of a flat-topped hill.

Vegetation: Dense stand of second-growth mixed conifer trees, including larch, western red cedar, ponderosa pine, white pine, and Douglas fir, with an undergrowth of wild rose and bracken ferns. In places there are considerable areas of open spaces in the woods. Trees are 3 to 4 feet apart as this area was burned over many years ago. A good number of the fir and larch are 1 to 3 inches in diameter, but the entire stand will vary to 18" D.B.H. Noticeable amount of moss on the trees.

Drainage: Well drained; both external and internal drainage are good. Low surface runoff, rapid permeability.

Parent materials: Glacial till consisting of the Belt series, which includes shales, sandstones, granites, quartzites, and argillite, with the possibility of a considerable mixing of loess or loesslike material on the immediate surface.

Biological activity: Some ants, many hornets, mosquitoes, but no legume worms.

Climate: At Priest River Experiment Station, Idaho, 7 miles south of sample site and 320 feet lower elevation, the January average of temperature is 23.3°F., the July average 64.2°F. Average length of growing season is 97 days. Average annual precipitation for 27-year record is 28.95 inches, divided as follows: January 3.98, February 2.81, March 2.52, April 1.94, May 1.84, June 1.80, July .85, August 1.03, September 1.70, October 2.51, November 3.66, and December 4.31. The average snowfall is approximately 85 inches.

Profile: S49-Ida-9-1

S49-Ida-9-1-1

A₀ 1/2-0" Dark gray fluffy mat fairly raw larch and fir needles, pH 5.4.

S49-Ida-9-1-2

A₂ 0-1 1/4" Grayish-brown (10YR 5/2; dark grayish-brown, 10YR 4/2, moist) very fine sandy loam with weak medium granular or soft crumb structure. There is a suggestion of platiness; very slightly plastic. This layer is very variable in thickness within a very short distance. It ranges from nil to 1/2 inch in less than a foot. In the field it was nearly white (10YR 7/2) but in collecting the sample some of the darker colored leaf mat was mixed with the sack sample and this darkened the entire layer. pH 6.8.

S49-Ida-9-1-3

A₂-B₂ 1/4-3/4 Light brownish-gray (10YR 6/2; brown, 7.5YR 5/4, wet) very slightly mixed

¹ An area 12" x 12" x 2" weighs 6 pounds, of which 1/4 pound is rounded shot 1/6 inch in diameter. Some rounded pebbles and a few angular gravel 1/4 to 1/2 inch in diameter.

plastic very fine sandy loam. Ranges when wet from dark brown (7.5YR 4/4) to reddish-brown (5YR 4/4) within short distances. pH 6.0. This layer was very difficult to collect and it includes some of the nearly white A₂ layer above and some of the distinct B₂ from layer below. Root channels and burrowing insects probably account for the intermingling of the two horizons.

S49-Ida-9-1-4

B₂₁ 3/4-4" Pale brown (10YR 6/3; dark yellowish-brown, 10YR 4/4, moist) soft friable very slightly plastic loam. This layer feels very fluffy and light in weight. No distinct structure in place, but digs out into weak indistinct crumbs. pH 6.5

S49-Ida-9-1-5

B₂₂ 4-10" Light yellowish-brown (10YR 6/4; dark yellowish-brown, 10YR 4/4, moist) fluffy loam or silt loam with fine crumb structure.

S49-Ida-9-1-6

B₂₃ 10-15" Very similar in structure, texture, and consistence to layer above. Moderate effervescence with H₂O₂. pH 6.3.

S49-Ida-9-1-7

B₃ 15-20" Pale brown (10YR 6/3; dark yellowish-brown, 10YR 4/4, moist) firm slightly plastic sandy loam with indistinct structural aggregates, somewhat mottled and slightly brittle. Some gravel. Moderate digestion with H₂O₂. pH 6.3.

S49-Ida-9-1-8

C₁ 20-31" Very pale brown (10YR 7/3; brown to yellowish-brown 10YR 5/3 to 5/4, moist) very slightly plastic sandy loam with considerable rounded gravel and some cobbles of granite, quartzite, and schist. Very slight reaction with H₂O₂. pH 6.4.

S49-Ida-9-1-9

C₂ 31-51" Light gray (5Y 7/2; olive gray, 5Y 5/2, moist) slightly plastic gravelly or cobbly sandy loam till of mixed material. This till is slightly brittle and appears to stop most of the roots. There is an abrupt change in the profile at 31 inches. All other layers, except the A₂, grade into each other. Roots are fairly evenly distributed to depth of 31 inches. The layer below 31 inches may be considered a very softly indurated pan. It forms an abrupt but wavy line.

Remarks: This profile is a very typical profile of the Brown Podzolic soils of northern Idaho. The soil appears to be very well drained and has developed from mixed materials but is possibly somewhat influenced by loessial deposits. In an area 2 feet square, with the leaf mat removed, 80 to 90 percent of the area was covered by a gray or white A₂ layer ranging from a film to 1/2 inch thick, but with pockets an inch thick. In places the B₂ is on top of the A₂, probably as a result of some biological activity.

Bonner County, Idaho

Pend Oreille loam

S491da 9-1-1 to 1-9

Lab. Nos. 49913 to 921

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %						VCS
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS
1/2-0	A ₀	--	--	--	--	--	--	--	5.0	--	--	--	--	--	--	--	--
0-1/4	A ₂	16.9	2.4	0.9	0.2	18.4	38.8	52	6.0	7.8	8.3	38.1	64.7	11.1	6.9	2.1	3.0
1/4-3/4	A ₂ & B ₂	10.6	1.6	0.7	0.2	15.2	28.3	46	6.0	3.10	5.8	41.3	65.1	15.2	6.5	1.9	3.1
3/4-4	B ₂₁	4.8	1.0	0.7	0.1	16.5	23.1	28	6.2	1.38	4.5	37.0	60.3	15.2	8.2	3.0	4.8
4-10	B ₂₂	3.1	0.4	0.5	0.1	14.8	18.9	22	6.2	1.15	3.8	36.5	60.2	15.6	8.3	3.0	4.7
10-15	B ₂₃	3.0	0.5	0.4	0.1	11.4	15.4	26	6.3	0.62	3.6	31.6	55.3	15.0	10.3	3.8	6.3
15-20	B ₃	2.5	0.8	0.2	0.1	2.5	6.1	59	6.3	0.16	5.3	22.6	42.8	13.7	15.1	6.1	9.4
20-31	C ₁	2.6	0.6	0.1	0.1	1.9	5.3	64	6.2	0.13	5.5	20.0	40.7	13.3	14.7	6.6	10.2
31-51	C ₂	2.3	0.6	0.1	0.1	0.9	4.0	78	6.4	0.03	7.5	12.9	24.8	13.8	19.7	9.5	14.1
																	10.6

Pend Oreille loam¹--Brown Podzolic

Collectors: Ableiter, Baker,⁴Gieseke, Leighty, Roberts, and Williams. July 7, 1949, 10:00 a.m. to 2:00 p.m.

Location: Bonner County, Idaho, NW 1/4, NW 1/4 NE 1/4 Sec. 5, T. 58 N., R. 1E., 8 miles east of Colburn, Idaho, .4 mile east of road junction to the north. Site approximately 100 yards from east-west highway on the north side of the road.

Elevation: 2,600 feet.

Relief: Rolling to hilly. Sample collected on 3 to 5 percent slope.

Vegetation: Second-growth timber consisting of hemlock, larch, white pine, lodgepole pine, and Douglas fir. Little or no understory where sample was collected. Trees are very dense; most are 6 to 12 inches in diameter and 60 feet tall, and about 70 years old.

Drainage: Very well drained site. Good internal and external drainage but possibly not so well drained as site S49-Ida-9-1.

Parent material: Parent material appears to be very similar to that of the other sample of Pend Oreille loam collected approximately 24 miles southwest of this site.

Biological activity: Very little biological activity observed in this site.

Climate: Climate at Sandpoint, Idaho, 12 miles southwest of sample site and 500 feet lower elevation, January average temperature 25°F., July average 65.3°F. 121 days growing season. Mean annual precipitation for a 28-year period is 28.79 inches, divided as follows: January 3.82, February 2.79, March 2.60, April 1.86, May 1.84, June 1.72, July .70, August 1.02, September 1.65, October 2.45, November 3.99, and December 4.35. Air temperature at 10:00 a.m. in shade at sample site 64°F., at 3 inches below surface of soil 54°F. Air temperature in shade at 2:00 p.m. 70°F., at 3 inches below the surface of the soil 58°F.

Profile: S49-Ida-9-2

S49-Ida-9-2-1

A ₀₁	1 1/2-1"	Dark gray slightly decomposed hemlock needles. pH 5.2. This layer is mostly F layer.
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S49-Ida-9-2-2

A ₀₂	1-0"	Very dark grayish-brown well decomposed organic mat with a small amount of mineral matter. Moderate digestion with H ₂ O ₂ . pH 5.0.
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S49-Ida-9-2-3

A ₂	0-1/4"	Light gray (10YR 7/1; gray, 10YR 5/1, moist) very slightly plastic loam or very fine sandy loam with moderate fine platy structure. Moderate digestion with H ₂ O ₂ . pH 5.0. This layer essentially continuous, but varied in thickness with pockets as deep as 1 inch. Many roots.
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S49-Ida-9-2-4

B ₂₁	1/4-1"	Brown (10YR 5/3; dark brown, 7.5YR 4/3, moist) soft very friable fluffy loam, light in weight; some shot. In places, a weak orterde. Roots numerous, some of which are quite large. Moderate digestion with H ₂ O ₂ . pH 5.3.
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¹ An area 12" x 12" x 6" weighs 18 pounds, 1 1/2 pounds of which is shot, mostly small and hard. There is also about a quarter of a pound of angular gravel.

S49-Ida-9-2-5

B₂₂ 1-5" Light yellowish-brown (10YR 6/4; dark brown, 7.5YR 4/2, moist) loam with weak fine crumb structure. Soil forms a soft friable fluffy mass when dug; slightly plastic. Some small shot. Roots not so pronounced as in layer above. A few stones. Moderate digestion with H₂O₂. pH 5.3.

S49-Ida-9-2-6

B₃ 5-11" Light yellowish-brown (10YR 6/4; dark grayish-brown, 10YR 4/2, moist) marbled yellow and gray very friable loam with weak fine crumb structure; slightly plastic. A few shot 1 mm. in diameter and also a few firm aggregates. Strong digestion with H₂O₂. pH 5.8. Some gravel.

S49-Ida-9-2-7

C₁₁ 11-17" Light gray (2.5Y 7/2; olive brown, 2.5Y 4/4, moist) gravelly very fine sandy loam. Friable to brittle and very slightly plastic when wet. Very slight digestion with H₂O₂. pH 6.4.

S49-Ida-9-2-8

C₁₂ 17-31" Similar to layer above except more stony and more distinctly mottled gray and brown with yellow. This is the weathered till. Considerable quartzite and rhyolite cobbles 2 inches in diameter in this layer. No digestion with H₂O₂. pH 6.2.

S49-Ida-9-2-9

C₁₃ 31-43" Pale yellow (5Y 7/3; olive, 5Y 5/3, moist) very slightly plastic, firm to somewhat compact stony sandy loam. Unweathered or very slightly weathered till. No reaction with H₂O₂. pH 5.8. Very little mottling in this layer except in fine old root channels. The coatings of the root channels are strong brown and yellowish brown in an olive brown soil matrix. This layer is micaceous and the principal rocks appear to be granite and quartzite. The gravel and cobbles range from 1 1/2 to 14 inches in diameter. Very few roots. Ten pounds of soil includes 1 1/2 pounds of particles gravel size or larger.

S49-Ida-9-2-10

C₂ 43-50" Very similar to layer above except little or no evidence of weathering.

Remarks: This soil appears to be typical of the Brown Podzolic soils of Northern Idaho and appears to be very similar to the Alderwood soils as mapped in western Washington.

Pend Oreille loam

Bonner County, Idaho

S49Ida 9-2-1 to 2-10

Lab. Nos. 49923 to 932

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1 1/2-1	A ₀₁	--	--	--	--	--	--	--	4.7	--	--	--	--	--	--	--	--	--
1-0	A ₀₂	--	--	--	--	--	--	--	4.6	--	--	--	--	--	--	--	--	--
0-1/4	A ₂	4.4	0.6	0.5	0.1	10.2	15.8	35	4.7	2.77	4.9	40.6	64.9	19.8	6.1	1.2	1.7	1.4
1/4-1	B ₂₁	1.5	0.5	0.5	0.1	22.2	24.8	10	4.8	4.33	5.8	39.9	63.1	14.7	7.0	2.1	3.7	3.6
1-5	B ₂₂	0.9	0.4	0.4	0.1	17.9	19.7	9	5.7	1.68	3.9	38.3	61.3	15.0	8.0	2.6	4.6	4.6
5-11	B ₂₃	1.3	0.4	0.3	0.1	12.9	15.0	14	6.0	0.70	3.8	34.3	57.0	16.9	10.3	3.2	5.0	3.8
11-17	C ₁₁	2.1	0.3	0.2	0.1	2.6	5.3	51	6.0	0.12	6.4	22.5	41.1	18.8	16.6	4.9	6.6	5.6
17-31	C ₁₂	1.8	0.3	0.1	0.1	2.3	4.6	50	5.9	0.05	6.6	17.9	33.0	19.0	20.1	6.1	8.2	7.0
31-43	C ₁₃	1.7	0.3	0.1	0.1	2.2	4.4	50	5.9	0.05	6.3	11.9	27.2	20.9	22.2	6.9	9.8	6.7
43-50	C ₂	1.8	0.3	0.1	0.1	1.7	4.0	58	5.8	0.05	6.5	10.5	25.1	20.0	23.8	7.4	10.0	7.2

Unnamed series stony loam¹--Podzol

Collectors: Ableiter, Leighty, Roberts, and Williams, July 15, 1949, 10:00 a. m. to 1:00 p. m. Clear warm day.

Location: Alberta, Canada, 1.6 miles east of British Columbia line on Vermilion Pass road or .5 mile west of Boone Creek Bridge. Sample collected on north side of road just east of barrow pit where new highway branches off from old highway.

Elevation: 5,675 feet.

Relief: Gently undulating 3 percent slope with very irregular microrelief but no large swells or sags. Sample collected on rather extensive smooth area for mountain pass.

Vegetation: Englemann or white spruce, balsam fir, and lodgepole pine, with very little understory of shrubs; considerable moss on ground, very little on trees, and some on rocks exposed to sunlight. Many fallen trees and logs, but very little decayed wood. Rather dense stand of timber; trees 2 to 3 feet apart, 7 to 10 inches in diameter, and 60 feet high. One tree 75 years old, 8 inches in diameter.

Drainage: Well drained; low surface runoff, rapid internal drainage and rapid infiltration, and moderately rapid permeability. No evidence of perched water table unless the distinct A₂ is caused in part by a water regime.

Parent material: Mixed medium-to heavy-textured calcareous glacial till that is somewhat compacted; mostly sedimentary and metamorphic rocks, such as limestone, dolomite, shale, sandstone, quartzite; little or no basaltic rocks. Rocks are angular and some are lime coated within 12 inches of the surface.

Biological activity: Noticeable lack of macroscopic life in profile, but evidence of many squirrels, deer, and elk in the Park.

Climate: At Banff, about 30 miles south and east of sample site and 1,100 feet lower elevation, January average temperature 13.4, July average 56.8. Average annual precipitation for 23 years 20.68 inches, divided as follows: January 1.43, February .79, March 1.77, April 1.16, May 2.38, June 3.02, July 2.48, August 2.39, September 1.17, October 1.19, November 1.80, and December 1.06. Air temperature at sample site 72°F., at 4 inches below the surface of the soil 44°F., and at 22 inches 40°F., soil moist and felt cold.

Profile: S49-Alt-a-1

S49-Alt-a-1-1

2-0"

A dark brown fluffy and felty mat of needles and decayed bark. Surface covered by mosses. An abrupt boundary between this layer and the A₂. Roots concentrated along boundary. pH 4.4.

A₀₀A₀

S49-Alt-a-1-2

A₂ 0-1 1/2"

Light gray (10YR 8/1, light brownish-gray, 10YR 6/1, moist) friable very fine sandy loam with weak fine platy structure that crumbled readily to weak crumb. On drying, the soil is seen to become firm. This layer ranges from a film to 5 inches thick, is very wavy, and there are many pockets and tongues into the B₂ and B₃ horizons. In places this layer extends into the B₂ in 1/16 inch circular extensions.

¹ A volume 12" x 12" x 5" weighed 24 pounds, 3 pounds of which was gravel, mostly sharp angular, many quartzite and fine-grained sandstone, all siliceous. One limestone.

Abrupt boundary to the B₂. pH 4.7. Slight digestion with H₂O₂. Many fine roots and bits of charcoal scattered throughout.

S49-Alta-1-3

B₂₁ 1 1/2-2" Strong brown or yellowish red (7.5YR 5/6 or 5YR 4/6; yellowish-red to dark red, 5YR 4/6 to 2.5YR 3/6, moist) slightly plastic (when wet) loam which is firm to hard and brittle when dry, but friable, soft and mealy, when moist; very weak crumb structure. A considerable number of yellowish-brown shot about 1 to 2 mm. in diameter, and evidently high in MnO₂. This layer is light in weight. Tongues extend up into top of A₂ in places and may appear as circular extensions. This layer is good ortstein and grades into B₂₂. It is distinctly wavy. pH 4.8. Moderate digestion with H₂O₂.

S49-Alta-1-4

B₂₂ 2-5" Brownish-yellow or reddish-yellow (10YR 6/6 or 7.5YR 6/6; reddish-brown, 5YR 4/4, moist) loose fluffy very slightly plastic loam with very weak crumb structure. There are a considerable number of small shot. pH 5.2. Moderate digestion with H₂O₂.

S49-Alta-1-5

B₃₁ 5-10" Pale yellow (2.5Y 7/4 to 8/4; light olive brown, 2.5Y 5/4, moist) friable slightly plastic heavy loam to light clay loam with irregular weak subangular blocky structure which breaks to fine crumb when dry. pH 6.3. Weak digestion, but strong effervescence, large bubbles with H₂O₂.

S49-Alta-1-6

B₃₂ 10-15" Pale brown (10YR 6/3; yellowish-brown, 10YR 5/4, moist) friable slightly plastic leached till of gravelly clay loam texture. pH 7.0. This layer has larger aggregates than layer above. Strong effervescence with H₂O₂.

S49-Alta-1-7

C 15-25" Light gray (10YR 7/2; pale brown, 10YR 6/3, moist) calcareous slightly plastic gravelly clay loam. pH 8.2.

Remarks: Only one sample of this Podzol was collected. It is a well developed Podzol of the high mountains derived from calcareous clay loam glacial till. The A₀ layer is distinct, with abrupt change to A₂, which changes abruptly in color to B₂₁. The B₂₁ grades into B₂₂ and in places the B₂₂ practically rests under A₀ but this may be due to such outside forces as freezing and thawing. Layers below 5 inches merge with one another except that the boundary to the limy material appears to be abrupt in places and gradual in others. All layers are gravelly and stony. There is fair to good root penetration, but not so many roots directly below leaf mat as in the Brown Podzolic soils. Though shallow, considered to be ideal Podzol.

Lab. Nos. 49933 to 939

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %						CS	VCS
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS		
2-0	A00,0	--	--	--	--	--	--	--	4.6	--	--	--	--	--	--	--	--	--
0-1-1/2	A ₂	3.5	1.0	0.2	0.1	11.0	15.8	30	4.4	2.03	5.2	45.3	63.3	16.8	9.1	2.5	1.9	1.2
1-1/2-2	B ₂₁	0.9	0.8	0.6	0.2	44.0	46.5	5	4.8	5.1	4.0	32.9	52.0	18.3	9.5	4.1	6.4	5.7
2-5	B ₂₂	1.4	0.5	0.3	0.1	23.4	25.7	9	5.2	2.46	3.0	28.7	45.6	14.0	15.0	15.0	7.4	5.2
5-10	B ₃₁	3.2	1.2	0.1	<0.1	2.0	6.5	69	6.8	0.34	14.2	23.1	32.3	10.2	18.9	9.0	10.4	5.0
10-15	B ₃₂	8.4	3.2	0.2	0.1	1.1	13.0	92	7.2	0.54	23.3	23.2	32.3	8.9	15.1	7.8	8.5	4.1
15-25	C	18.8	1.1	0.1	0.1	0.0	20.1	100	7.8	0.22	13.7	19.9	33.8	13.2	17.0	7.2	8.5	6.6

Breton loam--Gray Wooded

Collectors: Ableiter, Bowser, Leighty, Roberts, and Williams. July 19, 1949
8:30 a.m. to 1:30 p.m.

Location: Alberta, Canada, NE 1/4 NE 1/4 SE 1/4 Sec. 14, T. 48, R. 4 W. of fifth P.M., or 2 miles north and 1/2 mile east of Breton, Alberta. Site in a clump of aspen 300+ feet south of abandoned farm house on west side of highway.

Elevation: 2,800 to 2,900 feet.

Relief: Undulating, about 3 percent slope to east. In vicinity there are many low knolls and undulating swells to gently rolling hills with many depressions. The better drained areas of Breton loam are on the knolls, which are 100 to 300 feet across and may rise gradually from 10 to 25 feet higher than the adjacent depression like areas. Most of the land is cleared and in grain, clover, and alfalfa. Some erosion on 5 to 7 percent slopes in clean cultivated fields.

Vegetation: Trees mostly quaking aspen, with fairly thick growth of shrubs, such as alder, high-bush cranberry, service berry, strawberry and blue berry, and grass. In the vicinity the vegetation is dominantly aspen, balsam poplar, white spruce, willow, and the kind of undergrowth mentioned above. Trees are 2 to 3 feet apart in clumps, but there are lots of open spaces of grass and small shrubs, with additions such as fireweed and Indian paintbrush. Most of the aspen trees are 6 to 8 inches in diameter, 25 to 30 years old, and 30 feet tall. They are used for fire wood. Nearly every farm has a large pile 30 feet wide and 10 to 30 feet high. The area where the sample was collected appears to be virgin.

Drainage: Slow internal drainage and moderate infiltration. Soil appears to be well drained but the general impression of the general area is that small difference in relief makes a considerable difference in the degree of mottling in the profile, especially below the gray A₂ horizon.

Parent material: Parent material is from Paskapoo formation, which is a fresh-water deposit of Early Tertiary age. The parent material is a heavy-textured till, largely influenced by shales and sandstones, with very few boulders and gravels, not especially high in pH, and in places contains considerable charcoal.

Biological activity: A few ants, some large beetles, some fungi. Moss on tree stumps up to 12 inches above ground.

Climate: At Edmonton, about 55 miles northeast and 700 feet lower elevation, January average temperature 5.9°F., July average temperature 61.2°F. Average annual precipitation for 46 year period is 17.31 inches, divided as follows: January .87, February .64, March .67, April .82, May 1.81, June 3.13, July 3.39, August 2.40, September 1.39, October .73, November .69, and December .77. Air temperature at sample site 58°F., soil at 4 inches below surface 50°F., and at 50 inches 48°F.

Profile: S49-Alta-2

S49-Alta-2-1

A₀ 1 1/2-0"

This layer, essentially, H and F layers, consists of a nearly black, highly decomposed leaf litter that forms a spongy mat. It grades through a very thin A₁ into the A₂. pH 7.1.

S49-Alta-2-2

A₂₁ 0-2"

Light brownish-gray (10YR 6/2 when very dry; dark grayish-brown, 10YR 4/2, moist) very friable very fine sandy loam to silt loam that has a distinctly fine platy structure which breaks to fine crumbs. Not many pockets or tongues between this layer and the layer below. Some soft black concretions. This layer is high in organic matter. pH 6.6. It is slightly plastic. Many small roots.

S49-Alta-2-3

A₂₂ 2-8" Light brownish-gray (10YR 6/2 when very dry; dark grayish-brown, 10YR 4/2, moist) friable light silt loam or loam with moderate fine platy structure with some 1/16-inch fine subangular blocky aggregates. Some soft black concretions. The plates are grayer on top than on the bottom. pH 6.6. The soil is slightly plastic when wet.

S49-Alta-2-4

A₃ or B₁ 8-13" Light brownish-gray (10YR 6/2 when very dry; brown, 10YR 5/3, moist) plastic stiff heavy clay loam, with medium to small subangular blocky aggregates. pH 6.4. Slight reaction with H₂O₂. Roots common and a few pieces of gravel present.

S49-Alta-2-5

B₂₁ 13-21" Pale brown (10YR 6/3; brown, 10YR 4/3 to 5/3, moist) plastic moderately stiff heavy clay loam with strong fine to moderate blocky structure. Roots numerous and there are a few rounded gravel. Some small black concretions. pH 6.6. This is the heaviest layer in the profile. Aggregates have a gray siliceous silt and very fine sandy loam coating.

S49-Alta-2-6

B₂₂ 21-33" Slightly sticky and plastic clay loam to silty clay loam that is very similar in color to layer above. Strong moderate to fine blocky structure. The aggregates have a gray siliceous coating. pH 6.5.

S49-Alta-2-7

B₂₃ 33-40" Light yellowish-brown (2.5Y 6/4; olive brown to brown, 2.5Y 4/4 to 10Y 4/3, moist and crushed) clay loam with moderate medium to coarse blocky structure. Brown stains or skins on face of aggregates. Slight variegation of brown, yellowish-brown and olive brown in cross section of aggregate. Slight reaction with H₂O₂. pH 5.6. Bits of gravel and small roots.

S49-Alta-2-8

B₃ 40-47" Light yellowish brown to pale yellow (2.5Y 6/4 to 7/4 variegated brown, and olive brown, moist) silty clay loam. Firm to hard and lumpy when dry and slightly plastic when wet. Dug out into various sized blocky aggregates which were coated with a veneer of olive brown. pH 7.1. Moderate reaction with H₂O₂.

47-50" Not sampled. Contains some spots of lime. pH 8.0.

S49-Alta-2-9

C 50-57" Calcareous pale yellow (2.5Y 7/4; olive brown, 2.5Y 4/4, moist) somewhat vesicular weak fine blocky slightly plastic silty clay loam; inside of units light yellowish brown (2.5Y 6/4; light olive brown, 2.5Y 5/4, moist). Contains a moderate amount of large white lime splotches and some dark brown colloidal material along cracks. pH 8.0. This layer may possibly be of different till than layers above; more siliceous material and less dark colored minerals; particles fit together more loosely than layers above.

Remarks: A 3 1/2-inch rain wet the soil to a depth of 23 inches. All layers have some rounded gravel; roots not numerous below 9 inches, thick above 9 inches. Calcareous below 50 inches. Gravels are silica-coated. It is exceedingly difficult to determine the horizons below a depth of 33 inches. The layers below a depth of 33 inches may all be C. All horizons gradually grades into horizons above and below, no sharp or abrupt boundaries.

S49Alta 2-1 to 2-9

Lab. Nos. 49940 to 948

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1/2-0	A ₀	--	--	--	--	--	--	--	6.6	--	--	--	--	--	--	--	--	--
0-2	A ₂₁	11.2	0.7	0.6	0.1	4.9	17.5	72	6.4	1.31	10.2	35.0	61.7	11.2	9.8	3.9	2.5	0.7
2-8	A ₂₂	16.4	1.3	0.4	0.1	3.7	21.9	83	6.3	0.67	17.3	27.3	45.4	12.4	15.6	5.2	2.8	1.3
8-13	A ₃ or B ₁	16.6	2.0	0.3	0.1	4.4	23.4	81	6.0	0.52	29.1	21.7	33.6	10.6	15.1	6.3	3.9	1.4
13-21	B ₂₁	19.4	2.3	0.3	0.1	4.8	26.9	82	5.7	0.44	31.1	23.3	35.3	11.2	13.9	5.1	2.8	0.6
21-33	B ₂₂	17.8	1.6	0.2	0.1	4.9	24.6	80	5.8	0.31	24.8	23.3	37.2	12.0	15.5	6.1	3.4	1.0
33-40	B ₂₃	24.8	1.3	0.2	0.2	4.8	31.3	85	5.7	0.28	27.1	28.7	47.8	11.7	10.2	2.2	0.9	0.1
40-47	B ₃	25.3	1.6	0.2	0.2	3.0	30.3	90	6.6	0.27	22.6	31.8	56.0	9.9	9.1	1.7	0.6	0.1
50-57	C	35.7	2.3	0.1	0.1	0.0	38.2	100	7.6	0.21	19.5	30.7	56.6	12.1	9.4	1.6	0.6	0.2

Breton loam--Gray Wooded

S49-Alta-3

Collectors: Ableiter, Bowser, Leighty, Roberts, and Williams. Pit was dug and several layers collected from 4:00 p.m. to 6:30 p.m. July 19, 1949. Cloudy and rain at 6:30 p.m. Sampling completed July 20, 1949 8:00 a.m. to 9:30 a.m. Fairly easy to dig; not very many stones or gravel.

Location: Alberta, Canada, NE corner SE 1/4 Sec. 27, T. 47, R. 1 W. of fifth M., or 9 miles south of Thorsby, Alberta. Sample collected 100 feet southwest of the 1/4 section line fence and about 75 feet west of north south road. Sample collected in area that was burned over several years ago and is now used as pasture for a few dairy cows.

Elevation: 2,900 feet.

Relief: Nearly level to undulating with shallow swales and low ridges. This field would be easy to clear and level. Cost approximately \$20 to \$25 an acre, 1949 prices. The general area has rolling relief with many knolls and swales.

Vegetation: Burned-over land with many charred logs and dead standing trees. Young growth approximately 8 feet high and 1/4 to 1 inch in diameter of aspen with some white birch, and smaller willows; definitely an open stand of timber with many areas in grass. Ground cover of roses, cranberries, gooseberries, blue berries, June berries, vetch, blue grass, Indian paintbrush, strawberries, and other shrubs and forbs.

Drainage: Surface drainage fair, but drainage through the soil is slow; some mottling in profile which indicates impeded drainage. Depressions have poorly drained soils with a dominance of peat and muck surface layers ranging from 2 inches to 2 feet thick.

Parent material: Parent material is from Paskapoo formation, which is a fresh-water deposit for Early Tertiary age. The parent material is a heavy-textured till with very few boulders and gravels, not especially calcareous, and in places contains considerable charcoal.

Biological activity: Many ants under old burned logs, very small amount of mycelia. Evidence of rodents not pronounced.

Climate: At Edmonton, about 35 miles northeast and about 750 feet lower elevation, January average temperature 5.9°F., July average temperature 61.2°F. Average annual precipitation for 46-year period is 17.31 inches, divided as follows: January .87, February .64, March .67, April .82, May 1.81, June 3.13, July 3.39, August 2.40, September 1.39, October .73, November .69, and December .77. Air temperature at sample site 4:00 p.m. July 19, 1949 64°F., at 4 inches in soil 56°F. At 9:00 a.m. July 20 air temperature 54°F., at 3 inches in soil 52°F., and 40 inches 50°F.

Profile: S49-Alta-3

S49-Alta-3-1

A₀ 1 1/2-0" Nearly black, spongy and felty mat of decomposed aspen leaves, roots (many of them grass roots) and bark; on disturbance the material exhibits a fine crumb or granular structure. Abrupt change to layer below. Very strong digestion with H₂O₂. pH 7.0.

S49-Alta-3-2

A₂₁ 0-2" Light brownish-gray (10YR 6/2; dark grayish-brown, 10YR 4/2, moist) friable thin platy nonplastic fine sandy loam to loam. Top of plates are somewhat denser, smoother, and grayer than bottom of plates, which are rough, darker, and have many single sand grains. This layer has many small MnO₂ concretions, but no shot. This layer and A₀ is the area of maximum root development. pH ranges from 6.7 at 1/4 inch to 6.4 at 1 inch.

S49-Alta-3-3

A₂₂ 2-6"

Light gray (10YR 7/2; brown, 10YR 5/3, wet; pale brown, 10YR 6/3, moist and crushed) very slightly plastic, friable thin platy loam or very fine sandy loam. There are some angular quartzite gravel. Many small roots. Moderate digestion with H₂O₂. pH 5.5.

S49-Alta-3-4

A₃₁ 6-10"

Light gray (10YR 7/2 when very dry; brown, 10YR 5/3 moist) slightly plastic fine subangular blocky heavy loam to silt loam which is slightly mottled with gray and yellow in the center of the aggregates. Grades into layer below, no distinct boundary. Strong digestion with H₂O₂. pH 5.4.

S49-Alta-3-5

A₃₂ 10-14"

Light gray (10YR 7/2; brown 10YR 5/3, moist) slightly plastic moderate medium subangular blocky to blocky clay loam. Texture appears to vary from heavy loam or clay loam to sandy clay loam. Gray coatings on structural faces, and mottled brown, gray, and yellow pattern in cross section. In places the structure is dominantly fine granular; fine horizontal laminations also appear in place. Quartzite gravels are conspicuous but not numerous. Very little reaction with H₂O₂. pH 5.4.

S49-Alta-3-6

B₁ 14-19"

This horizon is a distinctly mottled brown (10YR 5/3), grayish brown (10YR 5/2), and light grayish brown (10YR 6/2), and a blending of these three colors. A heavy moderately plastic clay loam with moderate to strong medium subangular blocky aggregates some of which appear to be polished or to carry a thin skin of colloidal staining. Many streaks of strong brown (10YR 5/8), probably iron. Abrupt change to layer below in color and texture. pH 5.3.

S49-Alta-3-7

B₂₁ 19-23"

Mottled olive gray (5Y 5/2) gray, and strong brown plastic clay with faintly columnar aggregates 3 inches by 4 inches which break fairly easily into blocky to medium subangular blocky aggregates that are in places stained, possibly with organic matter. The upper part of this layer is coated with nearly white siliceous material. This is very distinct when the material is dry. The color of very dry aggregates is light brownish gray (10YR 6/2). The coatings do not penetrate so deeply into aggregates nor so far into the horizon as in the same layer in Breton loam S49-Alta-2. pH 5.3.

S49-Alta-3-8

B₂₂ 23-34"

Light brownish-gray (2.5Y 6/2 very dry; olive brown, 2.5YR 4/4, with some strong brown, 7.5YR 5/8, specks moist) plastic stiff silty clay to silty clay loam. Structure units 2 inches in width with colloidal veneer on structural breaks. Many soft decomposing gravels, purple, yellow, and gray. Some of the aggregates have a siliceous coating. Many decayed roots. pH 5.3.

S49-Alta-3-9

B₂₃ 34-40"

Similar to layer above except plastic silty clay loam, somewhat brittle, vesicular, pH 6.6.

C 40-62"

Olive gray calcareous plastic silty clay loam, with streaks of strong brown iron bands and white lime splotches. This is pale olive calcareous till which has some large boulders and rounded rocks and gravel. pH 8.2. Strong reaction with H_2O_2 .

Remarks: Main features of this profile are: (1) Abrupt change from A_0 to A_{21} ; (2) distinctly laminated A_{21} and A_{22} ; (3) darker A_{21} than A_{22} , especially in wet condition; (4) distinctly mottled A_{31} and slight mottlings in A_{32} ; (5) abrupt change from B_1 to B_2 ; (6) gradual color, texture, and structure change from A_{22} to B_2 (structure units larger with depth, grayer and heavier textured with depth); (7) roots well distributed from A_{22} to B_2 but few below that depth; (8) distinct gray silica coating of B_1 and B_{21} ; (9) MnO_2 concretions in A_{21} and A_{22} ; (10) horizons are difficult to determine below a depth of 34 inches, possibly layers below are the C horizons. From the limited observations made only July 18, 19, and 20 of the Breton soils this profile appears to be more typical of Breton loam than profile S49-Alta-2, especially in regard to acidity and degree of mottling in the profile.

It is the opinion of Roberts that this soil has developed from very old medium to heavy textured calcareous gray or white till under open forest cover with short growing season, cool temperatures, and summer rains. The gray color is probably due in part to the gray color of the parent material and in part to the heavy texture and kind of structure that does not permit rapid movement of air and water through the profile. He believes the same kind of profile would develop whether the parent material were calcareous or acid, all other conditions remaining the same.

Alberta, Canada

Breton loam

Lab. Nos. 49949 to 958

S49 Alta 3-1 to 3-10

Depth Inches	Horizon	M.E./100 Grams Soil							pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+	Clay			III	USDA Silt	VFS	FS	MS	CS	VCS	
1 1/2-0	A ₀	--	--	--	--	--	--	--	6.8	--	--	--	--	--	--	--	--	--
0-2	A ₂₁	8.4	1.2	0.6	0.1	6.7	17.0	60	6.0	1.36	11.4	27.2	48.8	11.6	14.4	6.7	5.1	2.0
2-6	A ₂₂	6.8	1.0	0.2	0.1	4.7	12.8	63	5.6	0.38	15.1	22.5	40.5	14.0	17.4	7.1	4.6	1.3
6-10	A ₃₁	11.8	3.3	0.2	0.2	4.5	20.0	78	5.3	0.42	25.2	19.3	32.6	13.4	17.0	6.7	4.2	0.9
10-14	A ₃₂	14.2	2.0	0.2	0.1	6.9	23.4	70	5.6	0.38	28.5	18.9	31.5	13.2	15.5	6.0	4.2	1.1
14-19	B ₁	14.7	2.5	0.2	0.2	7.5	25.1	70	5.3	0.39	29.5	19.2	31.7	13.2	15.4	5.7	3.7	0.8
19-23	B ₂₁	18.7	3.2	0.2	0.2	9.7	32.0	70	5.3	0.43	42.8	14.8	23.7	9.3	13.7	5.8	3.6	1.1
23-34	B ₂₂	17.6	2.5	0.2	0.3	7.2	27.8	74	5.2	0.32	28.1	19.3	30.3	12.2	18.6	6.7	3.2	0.9
34-40	B ₂₃	21.9	1.9	0.2	0.3	3.1	27.4	89	6.6	0.29	25.9	22.4	33.6	12.2	18.8	6.2	2.6	0.7
40-62	C	44.2	5.6	0.3	0.4	0.0	50.5	100	7.8	0.10	41.6	44.1	56.5	0.8	0.7	0.2	0.2	0.0

Ahmeek silt loam (Brown Forest)

Sampled August 17, 1949 by Kenneth Ableiter, Iver Nygard, R. J. Muckenhirn, and V. J. Kilmer.

Site is located along side road which goes southwest from Minnesota State Highway #1 about six miles northwest of Illgen City and 3 miles south of Finland. The sampling site is 8.7 miles southwest of the junction of the side road and Minnesota State Highway #1; it is 1.7 miles from the Lax Lake Store; 1 mile south of a bridge across a small creek; 1/2 mile south of three cabins, 2 of which are on the east side of the road; and 0.2 mile south of a summer cabin marked McGregor's Spring Hill Cabin.

Site is on slope of about 3%, generally east-facing. Pit dug 30 feet east of side road (gravelled) in stand of aspen (*Populus tremuloides*) about 4-8 inches in diameter, and a few *Amelanchier* 2 inches in diameter. Shrubs consist of hoary or tag elder, a large-leaved raspberry (*Rubus*), and a few small maples. Ground cover consists of large-leaved aster, balsam fir seedlings, bracken fern, and lycopodium.

Site is on prominent ridge with a valley and water course about 1 mile south and another 1 mile north, in area of rather high hills with many rock outcrops. Ahmeek soils found at several points nearby and on neighboring ridges within 6-8 miles of the site.

Outstanding profile characteristics:

1. Granular structure apparently due to earthworm activity in upper 5 inches.
2. General dark reddish brown color with lack of distinct horizonation specifically for A₂.
3. Compact or moderately firm layer at 22 inches.
4. Predominance of angular rock fragments, mostly dark colored.

A ₀₀		Very thin, 1/8 inch, loose leaves of aspen, fern fronds, twigs.
A ₁	0-5 1/2"	Medium granular silt loam, very dark brown (10YR 2/2) crushes to very dark gray (10YR 3/1). Granules distinct; firm when moist, fairly hard when dry. Roots of all sizes up to 1/4 in. in diameter make up about 25% by volume of horizon. Earthworms common; found seven in about 1/4 cubic foot of soil. Rocks consist of angular or semi-rounded dark fragments and make up 25% by volume of horizon; fragments generally 1 to 4 inches in diameter and consist of hard reddish sandstone, basalt and dark gabbro. There is a thin irregular grayish layer about 2 inches from surface; it is just under the main mat of roots and is about 1/2 in. thick. This layer is indistinct and impossible to separate clearly from adjacent material.
AB	5 1/2-7 1/2"	Dark reddish brown (5YR 3/3) mixed with dark reddish brown (5YR 2/2) medium silt loam. Medium to coarse granular structure with granules of each color distinct from each other. An abundance of fine (1/16 - 1/8 in.) roots present. About 25% of layer consists of generally flat rock fragments, 1/2 to 2 in. thick and 1 to 8 inches long. These consist of dark rocks with occasional granite. Worms not so plentiful as in horizon above.
AB	7 1/2-9"	Dark reddish brown (5YR-3/4) silt loam with fine granules, (5YR 3/3 crushed) 1 to 1 1/2 inches thick; this is a transitional layer and was not sampled. It is similar to the 5 1/2-7 1/2 in. layer except for fineness of aggregates.
B ₂₁	9-13"	Dark reddish brown (5YR 3/3 moist) gravelly silt loam, 5YR-4/4 to 5YR 4/3 when crushed. Texture judged to be gravelly clay loam by two members of the party. Structure consists of fine to medium crumb with about 1/4 of volume made up of medium granules. Roots present but not abundant.

B ₂₂	13-22"	Reddish brown (5YR 4/3) gravelly loam of fine to medium crumb structure. Gravel makes up 25% of mass. Roots about 1/4 in. in diameter present, but not abundant.
C ₁	22-37"	Dark reddish brown (5YR 3/4) loam which is reddish brown (5YR 4/4) when crushed. Firm when moist, hard when dry, massive in place; fragments porous but moderately resistant to crushing; when crushed, they fall apart into friable loam. One root 1/16 in. in diameter in this horizon. A few larger pebbles (3-4 in. in diameter) and many smaller make up about 10% of volume of this horizon.
C ₂	37-45"	Dark reddish brown (5YR 3/4 at field moisture) loam (heavy) with same color when crushed; slightly mottled with spots of (5YR 4/8) and (5YR 6/3). Consistence firm; soil breaks out into irregular fragments. Ten per cent by volume consists of pebbles 1/4-2 in. in diameter consisting of reddish sandstone, gabbro, basalt or diorite, and dark red ferruginous rocks.

Lake County, Minnesota

Ahmeek silt loam

S49Mm-38-1-1 to 1-6.

Lab. Nos. 49968 to 973

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-5-1/2	A ₁	13.4	2.0	0.6	0.2	24.6	40.8	40	5.2	8.5	17.0	42.4	59.5	4.4	6.6	3.5	6.1	2.9
5 1/2-7 1/2	AB	5.3	1.6	0.3	0.1	20.6	27.9	26	5.1	3.65	16.9	42.1	58.9	3.2	4.2	2.9	6.7	7.2
9-13	B ₂₁	4.2	1.3	0.2	0.2	16.8	22.7	26	5.1	1.58	14.8	21.3	32.8	5.5	8.5	7.0	16.0	15.4
13-22	B ₂₂	3.9	2.4	<0.1	0.1	11.7	18.1	35	5.5	0.77	10.5	12.8	23.3	11.4	13.7	9.8	17.7	13.6
23-37	C ₁	8.7	4.6	0.1	0.3	4.0	17.7	77	6.2	0.15	11.2	21.2	34.7	13.6	15.9	7.8	9.8	7.0
37-45	C ₂	9.4	4.9	<0.1	0.3	3.3	17.9	82	6.3	0.16	11.8	21.2	35.9	13.5	15.7	7.7	9.2	6.2

Omega loamy fine sand (Brown Podzolic).

Sampled August 18, 1949, by Kenneth Ableiter, I. J. Nygard, R. J. Muckenhirn, and V. J. Kilmer.

Area sampled has slope of 1-2%, in jack pine stand, with trees 3 to 8 in. in diameter. Underplanted with red pine about 18 inches high. Ground cover is wintergreen, blueberry (*Vaccinium pennsylvanica*), lichens, a daisy, and young plants of big bluestem (*Andropogon furcatus*), and *Antennaria neglecta*, and *Polytrichum* moss. Scattered jack pine twigs over a uniform layer of jack pine needles and bark.

Site located 200 feet west of north-south woods road and 150 feet south of east-west side road. These two roads intersect at the NE corner of the NW 1/4 of Sec. 36, T 45 N, R 20 W, Pine County, Minn. Sampling site therefore is in NW 1/4 of Sec. 36 only 150 feet from north boundary of Sec. 36. It is about 1.1 miles east of U. S. Highway 61 and Northern Pacific R. R. tracks and 2 1/2 miles south of village of Sturgeon Lake, Minn.

- A₀ 1/2 inch of loose pine needles, a few jack pine twigs, grass roots, and fungi mycelia. *Polytrichum* mosses present. Patches of 1/4 in. thick "H" layer, dark gray, soft humus, mixed with F layer, and sand grains. Patches are only 3 to 6 inches across, and are separated by areas covered with needles but without F and H layers.
- A₁ 0-2 1/2" Very dark grayish brown to very dark brown (10YR-3/2 to 2/2 when moist) loamy fine sand containing a mixture of rather pulpy organic matter, gray sand grains, charcoal fragments and fine plant roots. Charcoal present in pieces up to 1/4 in. in diameter. Some brown sandy material present. Charcoal too abundant to permit satisfactory determination of organic matter.
- A₃ 2 1/2-5" Light yellowish brown (10YR 6/4-crushed and fairly dry) brown (10YR 4/3 when wet) loamy fine sand with weak coarse to fine granular structure. Bound together by abundant roots; fibrous, woody and largely horizontal. Charcoal present in odd bits but was eliminated as much as possible from sample taken.
- B₂₁ 5-12" Reddish brown fine sand (5YR-4/4) when moist, and light brown (7.5YR-6/4) when dry. Roots penetrate this layer in all directions are fine, fibrous and light colored. Material packed in place, breaks to irregular coarse irregular fragments with tendency toward blocky or subangular shape. Fragments slightly resistant to crushing.
- Triplex pH 5.3.
- This layer thought by some members to be B₁, and No. 4 to be B₂; others believed it to be A₂ because of its light brown color on drying.
- B₂₂ 12-18" Horizon believed to be transitional; not recommended for analysis unless data from adjacent horizons indicate need. Yellowish red (5YR-5/6) when moist, fine sand, light reddish brown (5YR-6/4) when dry. Firmly packed in place same as layer below; weakly coherent. Very few small pebbles. Six or eight roots extending downward per square foot of horizontal area.
- B₃ 18-27" Yellowish red (5YR-5/8) fine sand, firmly packed in place like 35-44 in. layer; breaks to irregular large fragments which are slightly resistant to crushing. Single root present. More fine material in this horizon makes it seem more loamy than layer below.
- Triplex pH 5.5.
- C₂₁ 27-35" Reddish brown (5YR-4/4) when moist, fine and medium sand with (5YR-5/8) yellowish red streaks. Packed in place but not firm; breaks to very

weak irregular fragments which cannot be handled without breaking. Color is pink (5YR-7/3) when dry. No evidence of stratification in layer. Very few pebbles of granite and diorite.

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| C ₂₂ | 35-44" | Reddish brown (5YR-5/3) when moist, fine sand; firmly packed and breaks out into irregular fragments which are very friable, and which crush very easily to loose fine sand. Color is light reddish brown to pink (5YR 6/4 to 7/4) when dry. A few rounded pebbles present, some of dark igneous rocks and some of reddish sandstone. |
| C ₂₃ | 44-53" | A reddish brown to light reddish brown (5YR to 6/4, moist) medium and fine sand similar to layer below in all respects except for slightly greater amount of dark grains from thin dark seams, apparently water laid. Some material (5YR-6/8) reddish yellow, detectable. Not sampled. |
| C ₂₄ | 53-60" | A medium to fine sand which when moist is reddish brown to light reddish brown (5YR 5/4 to 6/4) and when dry is light reddish brown to pink (5YR 6/4 to 7/4). Appears to be about 75% quartz with the remainder ferromagnesium, orthoclase, and other minerals. pH in field by Triplex 6.0. |

S49Mm-58-1-1 to 1-8 Lab. Nos. 49974 to 981

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-2-1/2	A ₁	3.6	0.7	0.3	0.1	10.4	15.0	31	5.0	3.83	4.2	5.2	8.7	3.3	47.8	26.6	8.1	1.3
2 1/2-5	A ₃	1.5	0.3	0.1	<0.1	5.7	7.6	25	5.5	0.88	4.6	5.2	8.3	4.0	51.7	25.0	5.9	0.5
5-12	B ₂₁	0.8	0.2	0.1	<0.1	4.2	5.3	21	5.6	0.34	4.3	3.9	6.2	3.7	52.4	26.3	6.6	0.5
12-18	B ₂₂	--	--	--	--	--	--	--	5.6	0.11	3.6	2.1	3.9	4.1	55.7	25.9	6.3	0.5
18-27	B ₃	--	--	--	--	--	--	--	5.8	0.06	3.0	0.2	1.0	3.8	67.4	18.4	5.6	0.8
27-35	C ₂₁	--	--	--	--	--	--	--	5.9	0.05	1.2	0.0	0.2	3.3	50.9	35.0	8.7	0.7
35-44	C ₂₂	0.4	0.1	0.1	<0.1	0.9	1.5	40	6.1	0.05	0.9	0.0	0.3	7.1	71.5	18.7	1.5	0.0
53-60	C ₂₄	--	--	--	--	--	--	--	6.3	0.04	0.8	0.0	0.0	1.6	42.2	47.8	7.4	0.2

Omega loamy sand (Brown Podzolic)

Sampled August 20, 1949 by J. K. Ableiter, I. J. Nygard, R. J. Muckenhirn, and V. J. Kilmer.

Location: Douglas County, Wisc., near middle of south line of Sec. 24, T 45 N, R 11 W, between 5 and 6 miles of Solon Springs, Wisc., county highway "A", at a point 60 feet north of the macadam pavement. The site is 6 1/2 miles west of the Bayfield County line, and about 10 miles west of Barnes, Wisc.

Site: Dense stand of jack pines, 3 to 8 inches in diameter, Ground cover consists of blueberry, wild rose, wintergreen, occasional small grass clumps, sweet fern, and moss.

Site on flat area with 1-2% slope, among low ridges and swales having small differences in elevation, (6 or 8 feet). Openings in area have ground cover of sweet fern, big blue stem, herbs, and low grasses. The sandy plain has an undulating surface in general with limited areas of uniform slope.

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| A ₁ | 0-2" | <p>(A₁ horizon with mixed A₂). Horizon is so thin and variable that it is impossible to separate "salt and pepper" mixture of light and dark-colored sand grains.</p> <p>Very dark brown (10YR 2/2) moist, humus-rich sand sprinkled with light gray (10YR-7/2). Charcoal present in fragments up to 1/4 in. in diameter; also peaty organic matter, roots, and bits of wood and fungi mycelia. Very numerous fine roots and rootlets, generally horizontal, bind this layer together.</p> <p>Triplex pH 5.3.</p> |
| A ₃ | 2-4" | <p>Reddish brown loamy sand (5YR-4/4) when moist, with grayish patches and an apparent yellowish tinge. Light brown (7.5YR 6/4) to very pale brown (10YR-7/4) when dry. Numerous fine roots. Fairly coherent coarse granular structure; granules easily crushed but retain their shape when moist.</p> <p>Triplex pH 5.5.</p> |
| B ₂₁ | 4-11" | <p>Reddish brown loamy sand, (5YR-4/4) when moist. Slightly firm fragments which crush easily to coarse, soft granules. Dry color is light reddish brown, 5YR-6/4. Roots fairly numerous.</p> <p>Triplex pH 5.5.</p> |
| B ₂₂ | 1'-20" | <p>Yellowish red sand (5YR-4/6) moist and reddish brown (5YR 5/4) to reddish yellow (5YR-6/6) when dry. Several fine roots. A weakly coherent sand having indefinite coarse crumb structure; breaks out in large fragments of irregular shape. Pebbles 1/2 basalts, remainder equally divided among sandstones, granites, and quartzite. Triplex pH 5.8.</p> |
| B ₃ | 20-26" | <p>Yellowish red sand (5YR-5/6) moist and reddish yellow (5YR-6/6) when dry. Pebbles consist of quartzite, sandstone, and basalt.</p> <p>Triplex pH 6.0.</p> |
| C ₂₁ | 26-35" | <p>Yellowish-red sand (5YR-5/6) when moist. Very weakly coherent. When dry, light reddish brown, (5YR 6/4), generally with some fine particles (7.5YR-7/4). Pebbles about 1/3 basalt and 1/3 sandstone, and 1/3 quartzite, granite, and other minerals.</p> <p>Triplex pH 6.0.</p> |

- C₂₂ 35-40" Brown sand (7.5YR 5/4) moist, and light brown (7.5YR 6/4) when dry. Numerous dark colored grains; basalt, quartz, and granite present. Packed in place but loose when removed.
- Triplex pH 6.2.
- C₂₃ 40-49" Brown to light brown sand (7.5YR 5/4 to 6/4) moist and light brown to pink (7.5YR 6/4 to 7/4) when dry. Numerous dark colored grains in with the quartz sand. There are a few small rounded pebbles present which consist of granite, quartzite, or basalt.
- Triplex pH 6.0.

Omega loamy sand

Douglas County, Wisconsin

(Brown Podzolic)

S49Wis-16-1-1 to 1-8

Lab. Nos. 49982 to 989

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-2	A ₁	4.9	0.9	0.2	0.1	15.0	21.1	29	4.7	4.44	3.1	4.5	8.7	2.6	29.0	31.4	20.0	5.2
2-4	A ₃	1.0	0.3	0.1	<0.1	5.0	6.4	22	5.2	0.95	4.2	5.8	10.5	3.5	32.1	30.3	16.9	2.5
4-11	B ₂₁	--	--	--	--	--	--	--	5.4	0.37	4.4	4.8	8.3	2.8	31.4	30.8	18.3	4.0
11-20	B ₂₂	0.6	0.2	0.1	<0.1	2.1	3.0	30	5.3	0.12	4.3	3.1	6.4	3.2	36.2	30.7	15.5	3.7
20-26	B ₃	--	--	--	--	--	--	--	5.6	0.12	3.2	0.2	1.4	1.8	32.0	33.0	24.2	4.4
26-35	C ₂₁	--	--	--	--	--	--	--	5.8	0.07	1.8	0.0	0.0	2.2	21.8	48.5	23.0	2.7
35-40	C ₂₂	0.1	<0.1	<0.1	<0.1	1.0	1.1	9	6.2	0.07	1.2	0.0	0.0	0.3	16.5	42.5	35.1	4.4
40-47	C ₂₃	--	--	--	--	--	--	--	6.2	0.05	1.0	0.0	0.0	1.0	20.8	40.9	32.5	3.8

Ahmeek loam (Brown Forest)

Sampled August 20, 1949 by J. K. Ableiter, I. J. Nygard, R. J. Muckenhirn, and V. J. Kilmer.

Location: SE 1/4 of Sec. 6, T 45 N, R 1 E, town of Anderson, Iron County, 60 feet east of State Highway 122, about 2 1/2 miles north of Upson, Wis., and 1.3 miles North of the bridge crossing the Potato River (also called Alder Creek at this point), 1 1/4 miles north of Upson. The site is 1.0 mile south of the north boundary of the Iron County Forest and a white marker post for Tyler Forest is beside a hemlock tree at the roadside 0.1 mile south of the site. Deep valley to south. Two road signs "Hill", one facing south and one north, located west of sampling site.

Site: On north-facing slope of about 8%; sample taken near crest where slope levels off to 3-5%. Vegetation consists of thick stand of sugar or hard maple from 2 to 8 inches in diameter with an occasional tree 12 to 15 inches in diameter. A few yellow birch, hemlock, ironwood, basswood and oak trees occur in the stand. Ground cover consists of small maple seedlings about 4 in. high with a fair number of larger seedlings 1 to 2 feet high. Other plants practically absent. Occasional rocks 1 to 2 feet in diameter protrude through leaf litter. Ground surface is uneven with succession of "cradle knolls."

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|-----------------|-----------|--|
| A ₁ | 0-2 1/2" | Dark reddish gray (5YR 4/2 and 3/2) silt loam. Very numerous roots and rootlets. Coarse to medium granular and fine to medium crumb structure. Large granules numerous and noticeable. Color is mixture of dark and light, with some granules dark reddish brown. Grayness most pronounced at lower side of horizon. Pebbles present but rather few. Several spots of concentrated gray occur in this layer. Several earthworms per square foot. Triplex pH is 5.2. Dry color 5YR 6/2. |
| B ₂₁ | 2 1/2 -7" | Reddish brown silt loam, (moist 5YR-4/4) and moist crushed is yellowish red, (5YR-4/6). When dry, light reddish brown (5YR-6/4). Brown color in general but gray spots and patches occasionally found at upper limit. Structure is large crumb and crushes easily to soft, fine crumb. Numerous roots, fibrous to 1/4 in diameter; generally horizontal. Pebbles in fair numbers. Several earthworms per square foot. Triplex pH 5.5. |
| B ₂₂ | 7-19" | Reddish brown (5YR-4/4, when moist) silt loam which breaks out in irregular firm fragments that crush to soft, "fluffy" fine crumbs. Stones, 8-12 in. in diameter, embedded in this horizon; also fair number of pebbles. Lower part of this horizon seems to have slightly more clay than the upper part, and the upper part slightly more silt than the lower part; upper part also very slightly darker brown. Triplex pH 5.7. Dry color is light brown (7.5YR-6/4). |
| B ₂₃ | 19-24" | Reddish brown (2.5YR-4/4 when moist) loam which is slightly to moderately cemented and hardened in place. Breaks to irregular fragments. Pebbles and cobbles of red sandstone and dark basalt rocks present; mostly rounded, a few angular. Fragments crush with moderate resistance to angular smaller fragments. Roots few and small. Color when dry is reddish brown (5YR 5/3). |
| | | Triplex pH 5.8. |
| B ₃ | 24-30" | Reddish brown (5YR-4/4 when moist) gravelly loam. A few fine roots present. Pebbles and cobbles are present to extent of 10-20% of volume. Moderately cemented and hardened in place but not much so as horizon below; it also breaks out into moderately resistant fragments like those of layer below. Pebbles have about same lithology as in 30-42 in. horizon. Color when dry is light reddish brown (5YR-6/4). |

Believed to be B₃ layer. Triplex pH 5.8.

- C₁ 30-42" Reddish brown (5YR-5/3 when moist) sandy loam that is moderately cemented. Hard in place; breaks to irregular fragments which crush with moderate to strong resistance when moist. This layer is removed with difficulty; contains pebbles and cobbles to the extent of 20% of its volume. Most of the cobbles and pebbles are rounded, and consist of dark-colored rocks and red sandstone. Dark rocks include basalt, gneiss, and dense hard red rocks. This layer referred to as "lixivium" by J. O. Veatch. Color when dry is light reddish brown to pink (5YR 6/3 to 7/3). Triplex pH is 6.0.
- C₂ 42-48" Reddish brown (2.5YR-4/4 when moist) loam containing about 25% pebbles, mostly 1 to 3 in. in diameter. When dry, color is light reddish brown to pink (5YR 6/3 to 7/3).
- Triplex pH is 6.0.

Iron Co., Wisconsin

(Brown Forest)

Ahmeek loam

S49Wis-26-1-1 to 1-7

Lab. Nos. 49990 to 996

Depth Inches	Horizon	M.E./100 Grams Soil						pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+			Clay	III	USDA Silt	VFS	FS	MS	CS	WCS
0-2-1/2	A ₁	3.8	0.8	0.3	0.4	14.3	19.6	4.1	3.86	8.7	26.8	63.3	10.4	9.4	4.3	2.8	1.1
2-1/2-7	B ₂₁	1.9	0.7	0.2	0.1	22.7	25.6	4.5	2.76	9.9	23.9	61.2	11.0	8.4	4.1	3.4	2.0
7-19	B ₂₂	0.6	0.2	0.1	<0.1	16.0	16.9	5	1.61	4.8	23.8	65.4	11.4	8.9	4.6	3.5	1.4
19-24	B ₂₃	0.2	<0.1	0.2	<0.1	11.8	12.2	3	0.92	5.4	12.7	35.4	15.1	21.0	11.0	8.3	3.8
24-30	B ₃	0.2	0.1	0.2	<0.1	6.5	7.0	7	0.42	3.0	10.1	28.1	16.2	25.6	13.1	9.6	4.4
30-42	C ₁	0.5	0.1	0.1	<0.1	3.2	3.9	18	0.15	2.5	22.3	29.3	15.1	24.9	12.4	10.0	5.8
42-48	C ₂	1.0	0.5	0.2	<0.1	2.2	3.9	44	0.11	3.7	11.8	29.3	14.8	24.3	12.7	9.8	5.4

Hiawatha sand (Podzol)

Samples by J. K. Ableiter, I. J. Nygard, R. J. Muckenhirn and V. J. Kilmer. August 21, 1949.

Location: 20 feet east of earth road in NW 1/4 of Sec. 2, T 48 N, R 7 W. Sampling site is west of Hoist Lake, and about 1/4 mile south of junction of earth road and road to Lenawee lookout tower, which is 2 miles west and slightly north of this road junction. Sampling site is on slope of a ridge in an area of hilly, rolling sands. A similar ridge is 1/2 mile north and a westward curve in road is 1/4 mile south.

Site: East-facing slope of 4%. Stand of maples, birches, a few white oaks, pin cherry and aspen. Ground cover of bracken fern, wintergreen, occasional blueberry, and broad-leaved aster; these form a thick foliage cover about 2 feet high. Trees are up to 8-inches in diameter but most are saplings or of sizes under 6 inches.

This was the fourth high upland site for Hiawatha which was found to have a deep (60-80 in.) layer of silts and clays.

Time: Sample taken 4:00 to 6:30 P.M. in semi-twilight so color readings are unsatisfactory. (They have been checked more recently in the office.)

- | | | |
|-----------------|--------|---|
| A ₀ | 1-0" | (Mor--A ₀) Very dark brown (10YR-2/2 moist) when crushed, with some gray particles. This is made up of poorly decomposed, peaty organic matter, with fibrous roots. Feels spongy when pressed between the fingers. Gray sand grains present but are minor portion of layer. Bits of twigs, bark, leaves, and wood present; fungal mycelium identifiable. Constitutes a definite, fairly strong mat on surface. |
| A ₂ | 0-8" | Dark reddish gray sand (5YR-4/2 moist) and pinkish gray (5YR 7/2) when dry. Breaks out into weakly coherent, sub-rounded fragments or lumps which crush easily but form small crumb-like groups of particles. Contact of this layer with one above very distinct; less so with one below but is easily separated from it. This horizon varies in thickness around the pit from about 4 to 10 inches. Roots of all sizes up to 1/2 inch in diameter are abundant in this layer; more so than in any other but the A ₀ which has fine, fibrous roots only. pH is 5.3. |
| B ₂₁ | 8-13" | Dark reddish brown to reddish brown loamy sand (5YR 3/4 to 4/4, moist) cemented into ortstein in part; color when dry is light reddish brown (5YR 6/4) to light brown (7.5YR 6/4). Ortstein fragments are hard, angular, and difficult to fracture or crush. Orterde is more yellowish brown, weakly cemented, and easily crushed. Roots penetrate this layer vertically, but extend horizontally at top and bottom of it, and not in the body of it. The ortstein fragments are dark reddish brown on exterior and lighter brown on interior. This horizon extends into one below in irregular tongues. pH is 6.0. |
| B ₂₂ | 13-27" | Reddish brown loamy sand (5YR-4/4 moist) which is slightly cemented; breaks into irregular fragments, which crush easily. Dry color is light reddish brown (5YR 6/4). This layer has a more yellowish brown color than those below. Roots few. There are some areas where roots are concentrated and where the material is looser. Tongues of this layer extend into the one below. Triplex pH 6.0. |
| B ₃₁ | 27-41" | (B ₃ horizon) Reddish brown (2.5YR-5/4 moist) loamy sand which is reddish brown (5YR 5/4) to light reddish brown (5YR 6/4) when dry. Firmly cemented and hardened but not so much so as horizon below; also has a more reddish tinge. Breaks out into fragments of irregular shape like those of layer below. Pebbles of sand stones, basalt, gneiss, and granite present, all rounded. This layer appears to lack a mixture of light grayish particles which appear in background of layer below. pH is 6.0. |

B ₃₂	41-53"	Firmly to moderately cemented sandy loam which is reddish brown (5YR 4/4) when moist and light reddish brown, (5YR 6/4) when dry. This horizon is difficult to dig out vertically, being hard and resistant to the spade. When dug out horizontally, it can be removed much more easily. Fragments crush with moderate resistance, crushing suddenly and completely to loose sandy loam. This is the layer called "lixivium" by Veatch. It occurs commonly over a deeper layer of relatively impermeable material. Triplex pH 6.0.
C ₂₁	53-64"	Fine sandy loam, which is reddish brown (5YR 4/3) moist and light reddish brown (5YR 6/3) when dry. Approximately 60% of pebbles are hard sandstone, with basalt, granite, and slaty rocks making up remainder. Very weakly cemented or hardened; digs out in irregular, easily crushed, irregular fragments. Triplex pH 6.0.
C ₂₂	70-80"	Not sampled. A reddish brown or pinkish clay loam with a few inches of silt on top. pH of clay is 6.3.

S49Wis-4-1-1 to 1-7

Lab. Nos. 49997 to 1003

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-1	A ₀	--	--	--	--	--	--	--	4.4	--	--	--	--	--	--	--	--	--
1-8	A ₂	0.7	0.2	0.1	<0.1	2.2	3.2	31	4.8	0.51	2.4	10.5	20.5	9.1	33.4	23.0	10.2	1.4
8-13	B ₂₁	0.6	0.3	0.2	0.1	12.2	13.4	9	5.1	0.97	6.0	8.6	18.0	10.0	35.2	21.5	8.1	1.2
13-27	B ₂₂	0.5	0.1	0.1	<0.1	4.1	4.8	14	5.7	0.33	3.8	3.6	9.5	13.7	41.1	21.6	8.7	1.6
27-41	B ₃₁	0.2	0.1	0.1	<0.1	2.1	2.5	16	5.6	0.15	2.0	2.6	6.6	12.0	38.2	22.6	14.1	4.5
41-53	B ₃₂	0.3	0.1	0.1	<0.1	1.7	2.2	23	5.8	0.13	2.5	4.4	9.3	11.8	39.4	21.8	12.0	3.2
53-64	C ₂₁	1.0	0.3	0.2	<0.1	1.3	2.8	54	6.0	0.08	4.5	11.1	20.0	13.7	34.0	17.2	8.5	2.1

Hiawatha loamy sand (Podzol)

Sampled August 22, 1949 by J. K. Ableiter, I. J. Nygard, R. J. Muckenhirn, and V. J. Kilmer.

Location: One hundred feet east of north-west to south-east side road at a point in the NW 1/4 of NE 1/4 of Sec. 13, T 50 N, R 8 W. 0.3 mile north of Wisconsin Highway #13 and along a side road going south-east from an intersection with #13 approximately 4 1/2 miles northeast of Port Wing and approximately 2 1/4 miles south-west of Herbster. Site is on second low ridge or terrace below top of slope and on the first marked rise above Highway #13.

Vegetation: White birch, oak, aspen, and maple trees from 2 to 8 inches in diameter; rather sparse, with an understory of birch saplings 3-5 ft. high. Ground cover consists of broad-leaved aster, Polytrichum moss, a few clumps of grass, and tall "everlastings" 30 in. high.

Surroundings: Site is a part of long and relatively high slope facing north toward Lake Superior with several "shoulders" or indistinct terrace like low ridges on it. Sandstone rock under 5 feet of Hiawatha soil at 0.1 mile north of sampling site; near site, deep sandy drift in evidence and a fair number of rounded erratics scattered on surface.

A ₀₀		Consists of 1/4 inch of birch, oak and broad-leaved aster leaves.
A ₀	1-0"	Consists of "F" and "H" material. This is pulpy, peaty, and dark gray to very dark brown or nearly black organic matter with slight mixture of sand grains. Contains fine roots, mycelia, bits of charcoal and twigs. Forms a strong mat which can be cut loose from soil and handled in patches or strips like carpeting. The top of this mat has partially decomposed leaves on it and the lower side grades into a very thin (1/4 inch) A ₁ .
A ₂	0-7"	Pinkish gray (5YR-6/2 moist) loamy sand which is very weakly coherent. Color ranges from dark reddish gray (5YR 4/2) wet to pinkish gray (5YR 7/2) dry. Contains numerous roots of all sizes up to 1/2 inch in diameter; most of them are horizontal. Slight gradation or admixture locally with horizon below, especially in patches or pockets. Boundary with horizon below is therefore irregular. pH is 5.2.
B ₂	7-16"	Loamy sand which is yellowish red to reddish brown (5YR 4/8 to 4/4) when moist and light brown (7.5YR 6/4) to reddish brown (5YR 5/4) when dry. It is weakly coherent and penetrated by a fairly large number of roots that are mostly woody and 1/8 to 1/4 inch in diameter. Pebbles are sandstones, granites, and basalts and are few in number. Spheres or zones, about 2-6 inches in diameter of darker brown cemented ortstein occur and extend downward into the horizon below. Appear to be old root channels filled with cemented sand. pH is 5.5.
B ₃	16-21"	Loamy sand which is yellowish red (5YR 4/6) when moist and reddish brown (5YR 5/4) when dry. It is very weakly coherent, with little tendency toward structure or fracture. Abundant woody roots, generally 1/8 to 1/4 inch in diameter. Cylinders or tongues of cemented ortstein from horizon above extend into and occasionally through this horizon. Large (18 inch) rock extends through this layer and into one above. pH is 6.0.
C ₁	21-34"	Weakly coherent sand which breaks into large, irregular, easily crushed fragments. Color when moist is yellowish red (5YR 4/6) to reddish brown (5YR 4/4) and when dry it is light reddish brown (5YR 6/4). Roots present, mostly vertical and woody, but not abundant as in upper layers. pH is 6.2.

C₂₁ 34-51" Medium sand with same color as the horizon above, except for a few more dark particles. Horizon has finer sand at upper limit and coarser (medium) sand on lower part. The sand shows a definite coherence and breaks out in irregular fragments which crush easily and completely when pressed. There are a few pebbles present and these are small, about 1/2 inch in diameter. About 1/3 are sandstone, 1/3 are basalt, and remainder are quartzite, granite, and other rocks. Few roots present.

pH is 6.2.

C₂₂ 51-64" Fine to medium sand which is reddish brown (5YR 5/4) when moist and pink (5YR 7/4) when dry. pH is 5.7.

Inspection of sides of pit in C (34-51 in.) horizon showed evidence of stratification, especially a few thin (1/4--1 in.) layers of finer sand but large irregular masses of light colored sand were also traceable. Boring to 87 inches revealed only loose, light colored sand such as is in the 51-64 inch sample. One hardened, very fine sand about 2 inches thick was found at 51 inches but no evidence of pinkish lacustrine clay or of a zone of wetness was observed. The very fine sand lens had a pH of 6.0. A sample of this lens was taken as a matter of interest for the Soil Survey Division, since it is believed that layers similar to this are responsible for impeding percolation and maintaining a better supply of moisture and nutrients in this soil.

Hiawatha loamy sand

Bayfield County, Wisconsin

(Podzol)

S49Wis-4-2-1 to 2-7

Lab. Nos. 491004 to 1010

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAR	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1-0	A ₀	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--	--
C-7	A ₂	0.6	0.1	0.1	<0.1	1.3	2.1	38	4.8	0.44	1.9	4.5	6.8	2.6	27.6	29.8	26.3	5.0
7-16	B ₂	0.4	0.2	0.1	0.1	9.1	9.9	8	5.9	0.81	5.9	3.2	4.4	3.2	36.7	27.9	16.3	5.6
16-21	B ₃	0.3	<0.1	0.1	0.1	3.9	4.4	11	5.4	0.35	2.6	1.0	0.9	2.1	43.2	31.5	15.6	4.1
21-34	C ₁	0.1	<0.1	<0.1	<0.1	1.4	1.5	7	6.0	0.14	1.5	0.0	0.6	5.0	60.6	24.5	6.4	1.4
34-51	C ₂₁	0.2	<0.1	<0.1	0.1	1.3	1.6	19	6.0	0.13	1.6	0.0	0.1	3.9	46.3	21.8	19.8	6.5
51-64	C ₂₂	0.2	0.1	<0.1	0.1	1.0	1.4	28	5.8	0.07	1.7	0.7	6.9	13.2	36.5	32.2	8.3	1.2

Iron River loam (Podzol-moderate)

Sampled August 23, 1949 by J. K. Ableiter, I. J. Nygard, R. J. Muckenhirn, and V. J. Kilmer.

Location: Fifty feet east of Bayfield County Highway D at a point marked on the west side of the road, by painted rocks arranged in letters "Watershed Elevation 1464" referring to the fact that this point is the divide between Lake Superior drainage and St. Croix-Mississippi River drainage. The site is located in the SW 1/4 of Sec. 11, T 44, R 6 W, 1/4 mile from the intersection of County Highway D and the road to the "Long Mile" look out tower, which is 1 mile east of D in Sec. 12, T 44N, R 6 W.

Site: On a slope of about 3-4% with many surface irregularities, especially pits and hummocks, each 1 to 3 feet below and above the general surface, respectively. These are commonly referred to as "cradle knolls" and are the result of uprooted trees making pits and hummocks. Occasional rocks on surface, and good cover of maple leaves, twigs, branches, and scattered grasses. Understory chiefly maple seedlings. Stand consists of maple saplings 1-3 in. in diameter, basswood and birch 3-8 inches in diameter and occasional cherry saplings, oaks, and aspen.

A ₀₀		Leaves of maple, oak, aspen mixed with acorns and twigs.
A ₀	1 1/2-0"	Mat-like spongy organic matter consisting of partially decomposed organic matter bound together with fine fibrous roots. Readily separated from mineral soil in mat-like pieces. Fragments of wood and charcoal present.
		Very dark grayish brown (10YR 3/2) to very dark brown (10YR 2/2) when dry and nearly black (10YR 2/1) moist. Roots appear to be more concentrated at lower boundary.
A ₂	0-3"	Reddish gray (5YR 5/2-moist) very fine sandy loam. Color ranges from dark reddish gray (5YR 4/2) wet to pinkish gray (5YR 6/2) dry. Breaks out into irregular crumbs and lumps 1/8--1/2 in. in diameter with suggestion of coarse platy structure. Lumps are weakly coherent and bound together by fibrous roots, which are abundant in horizon and generally 1/8 in. or less in diameter. Few pebbles present.
A ₃	3-5"	Dark reddish gray (5YR-4/2 moist) loam or very fine sandy loam. Color ranges from dark reddish brown (5YR 3/3) wet to light reddish brown (5YR 6/3) dry. Digs out into subangular blocky aggregates 1/8 to 1/2 inch in diameter. Aggregation is imperfect, about 1/2 of layer being in soft fine crumb. Crushes easily. Roots abundant up to 1/4 in. in diameter. Pebbles few. This has appearance of humus-infiltrated horizon although in the A ₃ , not A ₁ position.
B ₂₁	5-9"	Dark reddish brown (5YR-3/4 moist) loam with medium crumb structure. Dry color is brown (7.5YR 5/4) to light brown (7.5YR 6/4). Breaks out in subangular fragments or nuciform aggregates in part but generally has a fluffy, loose, crumb structure. The fluffy character of this loose soil is common in the B horizons of loam and silt loam soils of the Podzol region.
B ₂₂	9-14"	Reddish brown (5YR-4/4 moist) loam; light brown (7.5YR 6/4) to light reddish brown (5YR 6/4) when dry. Breaks to firm, subangular fragments which crush easily to fine, loose crumb. Roots are fine and consist of large (1/8--1 inch) woody, tree roots mainly with few fibrous roots. Pebbles and rocks few.
B ₂₃	14-17"	Reddish brown (5YR 4/4 moist) loam which is compact and coherent in place. Breaks out into large angular lumps or fragments which crush with slight to moderate resistance to weak small granules or angular fragments. Roots very few and small. Dry color is light reddish brown (5YR 6/4).

B ₃₁	17-24"	Reddish brown (5YR 4/4 moist) sandy loam, cemented and compact in place. Hard to remove with a spade. Fragments vary in hardness, some being too hard to crush with fingers, others only moderately resistant to crushing. Part of "lixivium" or "GB" as mentioned for layer below. The fragments have a light gray or ashy tint altho generally reddish brown when moist. The dry color is light reddish brown (2.5YR 6/4). This is also characteristic of this layer. This one is the hardest and most difficult of the horizons of this profile to remove or cut with a spade.
B ₃₂	24-40"	Horizon called "lixivium" or "L" by Veatch, GB by Nygard. Reddish brown (2.5YR-5/4 moist) loam, probably nearer the fine sandy loam limit than the middle of the loam range. Dry color is light reddish brown (2.5YR 6/4). Few pebbles, micaceous schist and red sandstone recognized. Breaks out in firm, subangular fragments often with thin coating of light-colored sand grains. Crushes with moderate resistance to slightly coherent, crumbly loam. Pressure causes quick and fairly complete disintegration of lumps.
C ₂₁	40-52"	Reddish brown (2.5YR-4/4 moist) loam, mixed with a minor proportion of yellowish brown sandy loam. Dry color is light reddish brown (2.5YR 6/4). Seems to be compact in places but has a tendency to cohere into coarse, weak crumbs. Few pebbles are mainly red sandstone or basaltic.
C ₂₂	52-63"	Sandy loam to gravelly sandy loam, reddish brown color mixed with lighter reddish brown or reddish yellow. Loose and incoherent material, presumably glacial till. (Not sampled).

Bayfield County, Wisconsin

(Moderate Podzol)

Iron River loam

S49W1s-4-3-1 to 3-9

Lab. Nos. 491011 to 1019

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1 1/2-0	A ₀	--	--	--	--	--	--	--	4.8	--	--	--	--	--	--	--	--	--
0-3	A ₂	2.9	1.4	0.2	<0.1	8.6	13.1	34	4.4	1.96	7.9	19.9	40.9	11.1	19.6	10.8	7.2	2.5
3-5	A ₃	3.9	1.4	0.2	<0.1	10.1	15.6	35	5.1	1.61	8.6	19.0	40.2	11.3	19.5	11.2	7.1	2.1
5-9	B ₂₁	3.6	1.4	0.2	<0.1	14.1	19.3	27	5.3	1.56	8.8	17.8	37.4	10.6	20.4	11.6	7.9	3.3
9-14	B ₂₂	2.0	1.4	0.2	<0.1	9.9	13.5	27	5.6	0.86	6.9	14.6	32.8	13.0	23.6	12.3	8.4	3.0
14-17	B ₂₃	1.5	1.3	0.1	<0.1	7.3	10.2	28	5.7	0.53	6.4	12.7	29.2	14.2	25.2	13.1	8.6	3.3
17-24	B ₃₁	1.1	1.0	0.1	<0.1	4.0	6.2	35	5.8	0.20	4.0	11.8	26.6	14.3	26.9	14.3	10.0	4.0
24-40	B ₃₂	1.7	1.3	0.1	<0.1	2.7	5.8	53	5.4	0.10	5.6	12.2	28.1	14.8	26.5	13.4	8.4	3.2
40-52	C ₂₁	1.6	1.4	<0.1	<0.1	2.0	5.0	60	5.3	0.04	4.0	8.1	19.2	11.6	29.2	21.2	11.6	3.2

Iron River loam (Podzol)

S-49-Michigan-27-1-1

Sampled August 24, 1949 by J. K. Ableiter, R. J. Muckenhirn, I. J. Nygard, and V. J. Kilmer.

Location: North-facing slope of about 5% in the southeast quarter of Sec. 13, T 46N, R 41 W at a point approximately on the line between Ontonagon and Gogebic counties, Michigan. The site is on the Gogebic side of the line, three miles north of Beaton's Lake and 2.8 miles east of the junction between the side road alongside the site and the road to Beaton's and Bass lakes, which goes southeast from this junction. The site is six miles north east of U. S. highway 2 at a point where it crosses a railroad track.

Site: Seventy feet south or southeast of side road in a stand of small maples 2-6 in. in diameter, with occasional larger trees 12-16 in. in diameter. A few ironwood, elm, and basswood make up about 10% of stand. Ground cover consists of maple seedlings, with a few ferns, clumps of grass, and mosses. No understory. Many large stumps of yellow birch, pine, and other unidentified trees. Surface of ground is uneven, being covered with rotting tree trunks and logs and stumps and hollows which evidently are cradle knolls. Ground completely covered with fallen leaves.

- | | | |
|-----------------|---------------------------|---|
| A ₀₀ | 1/2 inch of maple leaves. | |
| A ₀ | 1 1/2-0" | Mat of partially decomposed leaves and roots, about 1/2 of each. Twigs, fibrous roots, and bits of wood abundant. Color when moist is (10YR 3/2-4/4) very dark grayish brown to dark yellowish brown. Forms a fairly tough mat easily separated from soil below. Spongy when pressed. Some charcoal present. |
| A ₁ | | (Not sampled) Very dark brown (10YR 2/2 moist) silt loam about 1/8--1/4 inch thick, containing organic matter in an advanced state of decomposition. Varies in depth being 1/2 in. in occasional spots. Flat reddish sandstone slabs 1/4-1 inch thick and 3-8 inches in diameter in this horizon and the one below. |
| A ₂ | 0-4" | Reddish gray loam (5YR 5/2 moist), darker near top of horizon. Dry color is pinkish gray (5YR 6/2). Numerous thread-like roots and many woody roots up to 1/8 in. in diameter. Structure fine or very fine crumb. Weak tendency to platiness in fragments, which are weakly coherent. This horizon varies in depth, and it is difficult to avoid inclusion of material from horizons above and below. pH 5.5. |
| B ₂₁ | 4-8" | Dark reddish brown (2.5YR 3/4 to 5YR 3/3 moist) loam, which breaks out in irregular lumps or fragments with rounded outlines. Crushes easily to fine crumb. Dry color is reddish brown (5YR 4/3). Abundant woody roots, generally 1/8 inch in diameter, but including finer ones also. There is a transitional layer of more grayish brown color at the top of this horizon but this was excluded from the sample taken. Pebbles few. This appears to be a humus-infiltrated horizon. pH 4.8. |
| B ₂₂ | 8-14" | Dark red to dark reddish brown loam. (2.5YR-3/6 to 5YR 3/3 moist). Dry color is reddish brown (5YR 4/3). Breaks out in large irregular lumps which crush with slight to moderate resistance to medium crumbly aggregates. When crushed, is light and fluffy to the touch. Has areas of duller reddish brown where more cementation is evident, apparently incipient ortstein. |

Roots not so abundant as in B₂₁, not so thick, and more branched.

pH 5.2.

- B₂₃ 14-22" Yellowish red to dark reddish brown (5YR-4/6 to 3/4 moist) loam. Dry color is reddish brown (5YR 5/4). Breaks out in irregular sub-angular lumps which crush with slight resistance to medium or coarse crumb. Material is more harsh and less fluffy when crushed than that of the B₂₂ but still gives the impression of lightness and looseness. Roots common but not abundant. pH 5.4.
- B₃₁ 22-25 Yellowish red to dark reddish brown (5YR-4/8 to 3/4 moist) fine sandy loam. Dry color is light reddish brown (5YR 6/4). Breaks out in angular, generally flattened fragments which crush quickly and crisply with slight resistance. This horizon similar to one below but is more yellowish. Roots few. This horizon is transitional to the one below but easily differentiated from the B₂₃ by physical properties--compactness or coherence, and grittiness or harshness when rubbed. pH 5.5.
- B₃₂ 25-40" Yellowish red to reddish brown (5YR-4/6 to 4/4 moist) sandy loam. Dry color is light reddish brown to pink 5YR 6/4 to 7/4. Compact and cemented into a mass which breaks to irregular fragments that crush fairly easily when moist. Hard when dry. Crushes quickly and completely when pressed to harsh sandy loam leaving weak or indefinite crumbs or granules. Removed with difficulty with a spade. The material has a grayish tint and is the layer referred to as "Lixivium" by Veatch and "GB" by Nygard. pH 5.5.
- C₂₁ 40-50" Reddish brown (2.5YR 4/4 to 5/4, moist) loam with tendency to crumb structure. Dry color is light reddish brown 2.5YR 6/4. Few pebbles. pH 5.5.
- C₂₂ 50-78" (Not sampled) Same as above but less red and tends to be a heavy loam. Saturated with water in lower 12 inches.

General comments: Outstanding impression is given by the deep rich brown of the B horizon, which seems to indicate a relationship to the Ahmeek or Brown Forest soils.

Iron River loam

S49NICH 27-1-1 to 1-8

Gogebic County, Michigan

(Podzol)

Lab. Nos. 491020 to 1027

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1 1/2-0	A ₀	--	--	--	--	--	--	--	4.9	--	--	--	--	--	--	--	--	--
0-4	A ₂	3.9	1.5	0.1	<0.1	5.1	10.6	52	4.8	1.44	5.2	17.8	37.7	13.7	22.4	12.7	6.4	1.9
4-8	B ₂₁	2.8	1.0	0.2	0.1	16.9	21.0	20	4.7	1.94	8.6	10.0	25.8	14.4	25.7	14.8	7.8	2.9
8-14	B ₂₂	1.8	0.7	0.1	0.1	17.8	20.5	13	4.9	1.90	6.1	8.7	25.7	16.1	28.3	14.0	7.1	2.7
14-22	B ₂₃	0.6	0.3	0.1	0.1	9.7	10.8	10	5.2	0.92	2.2	6.8	23.8	16.5	31.9	15.4	7.3	2.9
22-25	B ₃₁	0.4	<0.1	0.1	<0.1	5.8	6.3	8	5.4	0.50	1.3	4.7	19.5	16.4	35.8	17.6	7.6	1.8
25-40	B ₃₂	0.8	0.1	0.1	<0.1	4.4	5.4	18	5.4	0.24	4.3	11.1	25.2	13.7	31.0	15.4	7.6	2.8
40-50	C ₂₁	0.4	0.2	<0.1	<0.1	2.7	3.3	18	5.4	0.07	5.4	10.5	25.2	13.4	30.5	16.0	7.4	2.1

Waukon silt loam

Polk County, SW 1/4 SE 1/4, Section 22, Knute Township. Samples collected by Prof. P. B. McMiller and I. J. Nygard on October 6, 1948.

<u>No.</u>	<u>Inches</u>	<u>Horizon</u>	<u>Description</u>
	2-0	A ₀	10YR 3/2, very dark grayish brown, spongy Mor. Neutral.
	0-6	A ₁	10YR 3/1, very dark gray, heavy silt loam; moderately developed, medium granular structure, crushes to 10YR 4/2, dark grayish brown; few crystalline rocks; roots numerous. Very slightly acid.
3388	6-9	A ₃	10YR 4/2, dark grayish brown, heavy silt loam; crushes to 10YR 5/6, yellowish brown; moderately developed, sub-angular blocky structure; very few pebbles; numerous roots. Slightly acid.
33989	9-13	B ₂₁	10YR 5/4, yellowish brown, silty clay loam; crushes to 10YR 6/6, brownish yellow; few roots; very few pebbles; rather compact in place. The aggregates are coated with a few dark brown stains. Neutral.
33990	13-16	B ₂₂	10YR 5/6, yellowish brown, spotted with 10YR 2/2, very dark brown, silty clay loam; crushes to 10YR 6/4, light yellowish brown; weakly prismatic in place, breaking easily to well developed coarse blocky structure; few small granitic pebbles; few roots. Mildly alkaline.
33991	16-30	C ₀	2.5Y 9/4, very pale brown, clay loam; friable; massive; calcareous; few roots; many dolomitic pebbles. This layer is streaked with white lime segregations.
33992	30-40	C ₂	2.5Y 6/4, light yellowish brown, clay loam; massive; highly calcareous; many granitic and dolomitic pebbles.

Samples were taken from a pit underneath a moderate stand of mixed deciduous trees on a slope of 2-3% gradient. Vegetation: grove of mixed deciduous trees, aspen, balm of Gilead and oak predominate. Other trees are elm, box elder, pin cherry, and ash.

48Minn 60-1-2 to 1-7

Lab. Nos. 50136 to 141

Depth Inches	Horizon	M.E./100 Grams Soil						% B SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-6	A ₁	15.3	4.2	0.5	<0.1	5.9	25.9	77	6.4	2.22	20.7	21.3	39.2	15.5	16.1	4.3	3.0	1.2
6-9	A ₃	11.9	3.9	0.4	<0.1	4.5	20.7	76	6.4	1.00	18.9	17.5	32.9	16.5	20.0	5.8	4.0	1.9
9-13	B ₂₁	10.6	3.8	0.4	<0.1	2.2	17.0	87	6.5	0.54	19.5	12.0	25.3	16.4	23.8	7.5	5.3	2.2
13-16	B ₂₂	13.8	4.2	0.3	<0.1	2.0	20.3	90	7.0	0.48	21.6	10.7	23.7	17.4	23.7	7.4	4.5	1.7
16-30	C _c	19.1	4.3	0.2	<0.1	0	23.6	100	7.9	0.42	21.1	16.6	31.1	15.7	19.0	5.5	4.8	2.8
30-40	C ₂	19.1	2.5	0.1	<0.1	0	21.7	100	7.9	0.19	13.8	16.9	36.2	17.7	18.6	4.8	4.2	2.7

Waukon silt loam

Otter Tail County, Minnesota, 2 miles north of Dalton. SE 1/4 of SW 1/4, Sec. 36, Twp. 132N, R 42W. Samples collected by Prof. P. R. McMiller and I. J. Nygard on October 5, 1948.

<u>Field No.</u>	<u>Inches</u>	<u>Horizon</u>	<u>Description</u>
33962	0-7	A ₁	10YR 2/2, very dark brown, silt loam; well developed fine granular structure; very friable; abundant roots. Upon drying, white silica grains become evident. Mildly alkaline.
33963	7-10	A ₂	10YR 4/1, dark gray, silt loam; weakly developed coarse platy structure in place, breaking into fine granules which crush to 10YR 5/6, yellowish brown; roots numerous; pebbles few. Neutral.
33964	10-13	A ₃	10YR 4/2, dark gray brown, silty clay loam; moderately developed subangular, blocky structure, with light gray and white coatings on the aggregates, few organic and iron stains. Roots numerous, but less than in layer above. Very slightly acid.
33965	13-20	B ₂₁	10YR 5/3, brown, heavy silty clay loam. Well developed medium blocky structure; blocks mottled with 10YR 3/2, very dark brown; few roots; few pebbles; slightly acid.
33966	20-25	B ₂₂	10YR 5/4, yellowish brown, heavy silty clay loam, streaked with 10YR 2/2, very dark brown. Well developed coarse blocky structure, blocks are very firm and are coated with a few white, non-calcareous spots. Roots moderate; pebbles few; mildly alkaline. This layer is slightly prismatic in place.
33967	25-32	B ₃	10YR 6/4, light yellowish brown, silty clay loam, streaked with 10YR 2/2, very dark brown. Well developed very coarse blocky structure, the aggregates slightly coated with white specks. Many small pebbles; roots numerous; several old root channels; calcareous. This layer is slightly prismatic in place.
33968	32-42	C _c	10YR 6/3, pale brown, and 10YR 8/2, white, specked with 7.5YR 5/8, strong brown, silty clay loam; massive; many reddish yellow iron stains; few pebbles of granitic and dolomitic origin; few tap roots; highly calcareous.
	42-54		This is a transitional layer, not sampled.
33969	54-64	C ₂	2.5Y 8/4, pale yellow, spotted with 10YR 6/8, brownish yellow, light clay loam; massive; highly calcareous, lime segregations feathering out in all directions, at places web-like. Few iron segregations; few pebbles, largely granitic and dolomitic; few shale fragments. Moderately compact in place, easily friable when removed.

Samples were taken along a deep road cut in a strongly morainic area from the top of a rather high ridge on a 4 to 5% slope underneath a cover of oak and brush. Vegetation consists largely of red oak trees, with hazel, sumac, Juneberry shrubs and grass.

S48Minn 56-2-1 to 2-8

Lab. Nos. 50142 to 149

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-7	A ₁	19.0	10.0	0.9	<0.1	4.2	34.1	88	7.1	5.2	21.3	17.4	29.6	10.4	9.5	20.0	6.4	2.8
7-10	A ₂	15.6	3.6	0.6	<0.1	3.3	23.1	86	7.0	2.16	18.5	15.0	26.8	12.5	24.2	8.3	6.8	2.9
10-13	A ₃	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13-20	B ₂₁	12.4	4.3	0.4	<0.1	4.7	21.8	78	6.0	0.34	29.2	15.3	26.7	10.9	17.4	6.5	5.3	4.0
20-25	B ₂₂	19.1	9.7	0.3	<0.1	2.5	31.6	92	6.8	0.45	30.6	15.6	26.4	10.7	17.4	6.8	5.5	2.6
25-32	B ₃	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
32-42	C _c	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
54-64	C ₂	19.1	6.9	0.2	<0.1	0	26.2	100	7.6	0.14	20.9	19.2	33.2	12.8	18.7	6.7	5.5	2.2

Ontonagon clay (Podzol)

Sample was taken in 1948 by Humphreys, Larson, and Nygard as part of correlation samples for the Ontonagon County Survey. Colors were determined on vial samples in the office.

Location: NW of NW Sec. 30, T. 48N. 39W: Ontonagon County, Mich.

Sample numbers: 48 Mich. -66-4-1 to 6.

A ₀	1-0"	Grayish brown (10YR 5/2); very dark grayish brown (10YR 3/2) to dark brown (7.5YR 3/2) moist.
A ₂	0-6"	Pinkish gray (5YR 7/2); dark reddish gray (5YR 4/2) to weak red (2.5YR 5/2) moist.
B ₁	6-8"	Pink to pinkish gray (5YR 7/2-7/3); reddish brown (2.5YR 5/4) moist.
B ₂	8-24"	Pink (5YR 7/3); weak red (10R 4/3) moist.
C ₁	24-36"	Pale red to light reddish brown (10R 6/4 to 2.5YR 6/4); weak red (10R 4/4) moist.
C ₂	36"+	Same colors as above.

43Mich 66-4-1 to 4-6

Lab. Nos. 50215 to 220

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes μ							LS	MS	FS	VFS	USDA Silt	III	Clay	WS			
		Ca	Mg	K	Na	H	S+																					
1-0	A ₀	--	--	--	--	--	--	--	5.4	9.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
0-6	A ₂	2.8	0.7	0.2	0.1	6.9	10.7	36	4.1	1.50	36	4.1	1.50	36	4.1	1.50	36	4.1	1.50	36	4.1	1.50	36	4.1	1.50	36	4.1	1.50
6-8	B ₁	2.3	0.7	0.1	0.1	7.1	10.3	31	4.1	0.35	31	4.1	0.35	31	4.1	0.35	31	4.1	0.35	31	4.1	0.35	31	4.1	0.35	31	4.1	0.35
8-24	B ₂	7.8	3.3	0.3	0.2	10.1	21.7	53	4.2	0.31	53	4.2	0.31	53	4.2	0.31	53	4.2	0.31	53	4.2	0.31	53	4.2	0.31	53	4.2	0.31
24-36	C ₁	14.5	4.1	0.3	0.7	0	19.6	100	7.2	0.32	100	7.2	0.32	100	7.2	0.32	100	7.2	0.32	100	7.2	0.32	100	7.2	0.32	100	7.2	0.32
36+	C ₂	14.6	4.3	0.4	0.4	0	19.7	100	7.8	0.08	100	7.8	0.08	100	7.8	0.08	100	7.8	0.08	100	7.8	0.08	100	7.8	0.08	100	7.8	0.08

Berkshire stony loam (Podzol)

Sample was collected by Mr. N. Holowaychuk in 1948 while he was a member of the Division of Soil Survey correlation staff. Colors were determined on vial samples in the office.

Location: 0.7 mile east on State Highway #16 from fork in road at Aziscoos Dam, Oxford County, Maine.

Sample numbers: S48Me-9-4-1 to 7.

A ₀	3-0"	Very dark gray (10YR 3/1); black (10YR 2/1) moist. Two inches of leaf litter in various stages of decay over one inch of fine crumb mor.
A ₁	0-1/2"	Light brownish gray (10YR 6/2) to gray or light gray (10YR 6/1) silt loam; very dark grayish brown (10YR 3/2) moist.
A ₂	1/2-2"	Pinkish gray (7.5YR 6/2) silt loam; dark brown (7.5YR 3/2-4/2) moist. Soil has a floury feel when crushed. It has a weak platy structure in that it breaks more definitely along horizontal than vertical lines.
B ₂₁	2-5"	Orterde. Dark brown to brown (10YR 4/3 to 7.5YR 4/2), fluffy and friable loam with a weak, fine crumb structure; dark brown (7.5YR 3/2) moist. This horizon is generally 2 to 3 inches thick and merges with the lower horizon.
B ₂₂	5-15"	Light yellowish brown (10YR 6/4), friable loam with weak, medium crumb structure; dark yellowish brown (10YR 4/4) moist. Many roots.
C ₁	15-21"	Pale yellow (5Y 8/4), friable, faintly mottled, very fine sandy loam with weak, coarse platy structure; pale yellow (5Y 7/4 to 2.5Y 7/4) moist. Some roots.
C ₂₁	21-33"	Pale yellow (5Y 8/4) loam; pale yellow (5Y 7/4) moist. Firm in place, and is moderately resistant to the pick. Breaks out into irregular subangular clods that are moderately firm. Coarse skeleton of green schist and granitic stones 6 to 15 inches in diameter. These make up 10 to 15 percent of the soil.
C ₂₂	33-39"	Gritty loam with stones and fragments of green schist, phyllite, and granite. Friable; breaks up into irregular, subangular clods that mash easily. (No vial sample for color determination).

S43Me 9-4-1 to 4-8

Lab. Nos. 50221 to 50228

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
3-0	A ₀	--	--	--	--	--	--	--	3.6	22.2	--	--	--	--	--	--	--	--
0-1/2	A ₁	2.6	0.5	0.2	0.1	15.6	19.0	18	3.8	2.98	8.0	38.4	62.7	10.6	7.6	2.9	4.4	3.8
1/2-2	A ₂	1.0	0.4	0.1	<0.1	17.4	18.9	8	3.9	2.26	6.6	40.4	68.9	11.1	6.3	2.2	2.8	2.1
2-5	B ₂₁	0.7	0.8	0.1	0.1	33.3	35.0	5	4.1	4.56	9.1	43.6	67.6	9.6	5.8	2.4	3.2	2.3
5-15	B ₂₂	0.7	0.6	0.1	0.1	26.6	28.1	5	4.2	2.91	8.3	39.2	63.8	10.6	6.5	3.0	4.7	3.1
15-21	C ₁	0.2	0.9	0.1	0.1	7.4	8.7	15	4.8	0.24	9.9	36.9	63.4	10.8	6.2	2.8	4.0	2.9
21-33	C ₂₁	0.4	<0.1	0.1	0.1	6.1	6.7	9	5.0	0.19	8.5	30.5	50.8	10.8	10.2	5.0	8.0	6.7
33-39	C ₂₂	1.4	0.2	0.1	0.1	4.4	6.2	29	5.1	0.05	10.9	33.0	53.1	10.7	8.9	4.0	6.7	5.7

Worthington, Maine (1952)

Sample was collected by Mr. N. Holowaychuk in 1948 while he was a member of the Division of Soil Survey correlation staff. Colors were determined on vial samples in the office.

Location 1.8 mile northeast of Pittsburg, Coos County, New Hampshire.

Sample numbers: S48NH-4-4-1 to 8.

A ₀	2-0"	Very dark gray and very dark grayish brown (10YR 3/1 and 3/2), granular mor. Nearly black (10YR 2/1) to very dark brown (10YR 2/2) moist. The upper one inch contains a heavy mat of roots while the lower part is fine crumb with a tendency towards gray mor.
A ₂	0-4"	Light gray (10YR 7/1) loamy fine sand; gray (10YR 5/1) moist. Largely single grain, but some weak, fine platy structure, especially in the lower one inch. Contains pebbles and fragments of rock found in the till.
B ₂₁	4-9"	Yellowish brown (10YR 5/4) loam; dark yellowish brown (10YR 3/4) moist. This horizon is the orterde. It has a fluffy feel and a weak, very fine crumb structure. It is well permeated with roots of all sizes. Contains pebbles and rock fragments.
B ₂₂	9-15"	Light olive brown (2.5Y 5/4) loam; olive brown (2.5Y 4/4 to 3/4) moist. Very weak, fine crumb structure.
B ₃₁	15-23"	Light yellowish brown (2.5Y 6/4) to pale olive (5Y 6/3) very fine sandy loam; olive brown (2.5Y 4/4) moist. Weak, fine crumb structure. Has fewer roots than horizons above.
B ₃₂	23-25"	Pale olive (5Y 6/3) to light yellowish brown (2.5Y 6/4) very fine sandy loam; olive (5Y 4/4) to olive brown (2.5Y 4/4) moist. Weak, fine platy structure with some gray, horizontal coatings along the plates.
C ₂₁	28-50"+	Pale olive (5Y 6/3) loam; olive (5Y 4/4) moist. Firm; resists point of knife in place, but is friable when removed. Breaks out into irregular, subangular clods.
C ₂	At 144"	Pale olive (5Y 6/3) to light olive gray (5Y 6/2) loam; olive (5Y 4/3) to dark olive gray (5Y 3/2) moist. Slightly firm. Contains about 20 percent by volume of fragments and cobbles of phyllite, schist, and white quartzite.

Worthington loam

Coos Co., New Hampshire

(Podzol)

S48NH 4-4-1 to 4-8

Lab. Nos. 50229 to 236

Depth Inches	Horizon	M.F./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
2-0	A ₀	--	--	--	--	--	--	--	3.6	26.4	--	--	--	--	--	--	--	--
0-4	A ₂	0.3	0.2	0.1	0.1	6.4	7.1	10	3.8	0.44	2.4	23.5	48.7	22.2	11.5	3.5	5.2	6.5
4-9	B ₂₁	0.1	0.1	0.3	0.1	13.7	14.3	4	4.4	4.16	3.6	24.9	49.1	20.1	10.7	3.9	6.9	5.7
9-15	B ₂₂	0.2	0.1	0.4	0.2	3.2	4.1	22	4.8	1.17	2.9	21.1	49.8	21.2	11.8	4.0	6.5	3.8
15-23	B ₃₁	0.1	0.2	0.2	0.1	5.9	6.5	9	5.2	0.44	1.9	19.3	49.8	22.9	11.7	3.6	5.1	5.0
23-28	B ₃₂	<0.1	<0.1	0.2	0.1	6.1	6.4	5	5.1	0.29	3.5	27.9	58.5	17.6	8.6	3.1	4.8	3.9
28-50+	C ₂₁	0.1	<0.1	0.1	<0.1	4.4	4.6	4	5.0	0.10	7.2	27.3	52.0	18.2	8.3	2.8	4.7	6.8
At 144	C ₂₂	0.2	<0.1	0.3	<0.1	10.5	11.0	4	5.1	0.08	7.6	27.0	50.0	15.4	8.8	3.4	6.4	8.4

Clymer loam (Brown Podzolic?)¹

Location: Top of Big Savage Mountain; 0.7 mile south of U. S. Highway #40, Garrett County, Maryland.

Collectors: O. C. Rogers, L. T. Alexander, and E. Shaw. (Sample was taken primarily for the study dealing with zinc). Dry colors were determined on vial samples in the office.

A ₁	0-2"	Very dark gray to black (10YR 3/1 to 2/1), moist, friable loam. Dry color is dark gray (10YR 4/1).
A ₂	2-3"	Light gray (10YR 7/2), moist, loam; dry color is grayish brown (10YR 5/2) to light brownish gray (10YR 6/2).
B ₂₁	3-8"	Brownish yellow (10YR 6/6), moist, to olive yellow (2.5Y 6/6), moist, loam. Dry color is very pale brown (10YR 7/4). Weak, subangular blocky structure.
B ₂₂	8-20"	Same as above, except somewhat larger structural aggregates.
C	20"+	Yellow (2.5Y 7/8), moist, light loam. Dry color is pale yellow (2.5Y 7/4 to 8/4).

¹The present series description of the Clymer soils designates them as Brown Podzolic soils, although certain features of the A and B horizons suggest that they are Gray Brown Podzolic soils. This particular profile appears to be closer to a Podzol than the profile described in the series description.

Clymer loam

Garrett Co., Maryland

Profile #40
(Brown Podzolic)

Field No. 5

Lab. Nos. 50314 to 318

Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	VCS	
0-2	A ₁	1.9	1.0	0.3	0.2	22.2	25.6	13	4.2	7.1	12.1	28.5	47.0	11.7	13.4	7.6	3.8	4.4	
2-3	A ₂	0.4	0.3	0.2	0.1	16.9	17.9	6	4.2	3.35	13.3	28.5	47.1	11.2	13.0	8.0	4.0	3.4	
3-8	B ₂₁	0.1	0.1	0.1	0.1	9.6	10.0	4	4.6	1.11	15.2	29.5	47.4	10.7	11.6	7.0	4.0	4.1	
8-20	B ₂₂	<0.1	0.1	0.1	0.1	7.9	8.2	4	4.5	0.35	17.6	26.3	42.1	9.6	10.7	6.9	5.6	7.5	
20-28+	C	<0.1	0.2	0.1	0.1	7.3	7.7	5	4.5	0.25	15.0	28.5	40.8	7.2	10.6	7.4	5.9	13.1	

Leetonia sandy loam (Podzol)

Collectors: O. C. Rogers, L. T. Alexander, and E. Shaw. (Sample taken primarily for the study dealing with zinc). Dry colors determined on vial samples in the office.

Location: Two and one-half miles southwest of Thayersville, Garrett County, Maryland; and 5 1/2 miles northeast of Oakland, Maryland, along U. S. #219.

A ₀		Very thin. Areas show evidence of having been burned.
A ₁	0-3"	Very dark gray to very dark brown (10YR 3/1 to 2/2), moist, sandy loam. Color of vial sample remained the same, except for a few fine particles of light gray.
A ₂	3-9"	Light gray (10YR 7/2), moist, sandy loam. Dry color is pinkish gray (7.5YR 6/2 to 7/2).
B ₂₁	9-13"	Dark reddish brown (5YR 3/4 to 4/4), moist, sandy loam. Dry color is light brown (7.5YR 6/4) to reddish yellow (7.5YR 6/6).
B ₂₂	13-19"	Brownish yellow (10YR 6/6 to 6/8), moist, sandy loam. Dry color is very pale brown (10YR 7/4).
C	19-26"+	Yellow to brownish yellow (2.5Y 7/6 to 10YR 6/6), moist, light sandy loam. Dry color is very pale brown (10YR 7/4 to 8/4).

Leetonia sandy loam

Garrett Co., Maryland

(Podzol)

Field No. 6

Lab. Nos. 50319 to 323

Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %														
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	90%								
0-3	A ₁	--	--	--	--	30.0	--	--	3.8	12.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-9	A ₂	0.2	<0.1	0.1	<0.1	3.1	3.4	9	4.0	5.7	3.4	9.9	17.4	27.8	39.5	7.1	3.4	1.1								
9-13	B ₂₁	0.2	0.1	0.1	0.1	12.4	12.9	4	4.4	1.14	8.3	12.9	19.8	25.2	34.5	5.0	3.3	8.6								
13-19	B ₂₂	<0.1	0.1	0.1	0.1	5.7	6.0	5	4.6	0.41	8.8	12.1	10.6	26.0	33.7	5.9	3.7	8.9								
19 +	C	<0.1	0.1	0.1	<0.1	5.4	5.6	4	4.5	0.22	9.7	10.7	17.2	25.0	34.0	5.1	4.5	10.0								

Paxton loam (Brown Podzolic)

Sample was taken in 1941 for correlation files as a part of the Hillsboro County, New Hampshire survey. Colors were determined on vial samples in the office.

Collector: Charles S. Simmons.

Location: 4 miles northeast of Frankestown, Hillsboro County, New Hampshire.

Sample numbers: 1106123 to 1106126.

A ₁	0-4"	Brown (10YR 5/3) loam or fine sandy loam; very dark grayish brown (10YR 3/2) moist.
B ₂	4-16"	Brownish yellow (10YR 6/6) loam; dark yellowish brown (10YR 4/4) moist.
B ₃	16-24"	Light yellowish brown (2.5Y 6/4) loam; yellowish brown (10YR 5/4) to olive brown (2.5Y 4/4) moist.
C	24-36"	Pale yellow (2.5Y 7/4), compact, platy glacial till; olive brown (2.5Y 4/4) moist.

Hillsboro Co., New Hampshire

Paxton loam

Field Nos. 1106123 to 1106126 Lab. Nos. 50393 to 50396

Depth Inches	Horizon	M.E. /100 Grams Soil							pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+	Clay			III	USDA Silt	VFS	FS	MS	CS	VCS	
0-4	A ₁	0.2	0.2	0.1	0.1	20.1	20.7	3	4.0	4.28	6.9	14.6	30.6	16.5	20.2	8.3	10.4	7.1
4-16	B ₂	0.1	0.2	0.1	0.1	12.2	12.7	4	4.7	1.25	8.5	14.7	28.7	15.2	19.1	7.9	10.9	9.7
16-24	B ₃	<0.1	0.2	0.1	0.1	5.7	6.1	6	4.6	0.27	9.3	14.2	27.1	15.0	21.1	8.8	11.4	7.3
24-36+	C	0.1	<0.1	0.1	0.1	4.4	4.7	6	5.0	0.19	4.9	11.9	23.2	13.0	17.6	8.4	14.3	18.6

Gloucester bouldery stony loam (Brown Podzolic)

Sample was collected by Mr. N. Holowaychuk in 1948 while he was a member of the Division of Soil Survey correlation staff. Colors were determined on vial samples in the office.

Location: One mile southwest of Stafford Springs fair grounds on Crystal Lake road, Tolland County, Connecticut.

Sample numbers: S48Conn-7-3-1 to 5.

A ₁	0-4"	Dark grayish brown (10YR 4/2) loam with a few grayish brown (10YR 5/2) particles. Color when moist is very dark grayish brown (10YR 3/2). Weak to moderate, fine crumb structure.
B ₂₁	4-12"	Light yellowish brown (10YR 6/4) to brownish yellow (10YR 6/6) fine sandy loam; dark yellowish brown (10YR 4/4) moist. Weak fine crumb structure. Soil is friable and moderately loose.
B ₂₂	12-21"	Slightly paler than horizon above. The dry color is between light yellowish brown (10YR 6/4), very pale brown (10YR 7/4) and yellow (10YR 7/6). The moist color is approximately the same as that of the horizon above - dark yellowish brown (10YR 4/4). This is a gritty sandy loam with a weak, fine crumb structure. Thirty to fifty percent is a coarse skeleton of stones and boulders.
B ₂₃	21-36"	Pale brown (10YR 6/3) to very pale brown (10YR 7/3) sandy loam; brown (10YR 5/3) moist. Very weak, fine crumb structure. Tongues and pockets of the underlying gray, sandy till reach up into this horizon.
C	36-54"	Light gray (2.5Y) loose to slightly firm, loamy sand. Moist color is olive brown (2.5Y 4/4). Gneiss cobbles 3" in diameter constitute 15% of the volume.

Tolland Co., Conn.

Gloucester bouldery stony loam

Lab. Nos. 50397 to 50401

S48Conn-7-3-1 to 7-3-5

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-4	A ₁	2.1	0.5	0.2	0.1	21.5	24.4	12	4.1	5.9	7.2	11.6	29.8	15.4	23.9	10.1	10.6	3.0
4-12	B ₂₁	0.6	0.1	0.1	0.1	5.7	6.6	14	4.8	0.53	6.2	9.1	24.1	17.7	25.9	9.9	10.2	6.0
12-21	B ₂₂	0.6	0.1	0.1	<0.1	4.9	5.7	14	4.8	0.37	5.2	8.5	22.6	17.0	25.1	10.0	11.2	8.9
21-36	B ₂₃	0.4	<0.1	0.1	<0.1	3.7	4.2	12	4.8	0.21	3.2	8.5	20.0	17.8	27.9	10.9	12.5	7.7
36-54	C	0.1	<0.1	<0.1	<0.1	1.2	1.3	8	5.3	0.04	2.1	6.2	18.2	20.3	29.9	11.2	12.8	5.5

Acton stony loam (Brown Podzolic)

Sample was collected by Mr. N. Holowaychuk in 1948 while he was a member of the Division of Soil Survey correlation staff. Colors were determined on vial samples in the office.

Location: One mile southwest of Stafford Springs fair grounds on Crystal Lake road, Tolland County, Connecticut.

Sample numbers: S48Conn-7-4-1 to 6.

A ₁	0-4"	Mull. Dark grayish brown (10YR 4/2) loam; very dark grayish brown (10YR 3/2) to very dark brown (10YR 2/2) moist. Weak, fine crumb structure.
B ₂₁	4-13"	Light yellowish brown (10YR 6/4) to brownish yellow (10YR 6/6) heavy sandy loam; dark yellowish brown (10YR 4/4) moist. Weak fine crumb structure. Old root channels penetrating this horizon are filled with mixed dark organic and mineral soil.
B ₂₂	13-24"	Light yellowish brown (10YR 6/4) to very pale brown (10YR 7/4) heavy fine sandy loam; yellowish brown (10YR 5/4) moist. Very weak, fine crumb to soft fragmental structure. Grades into the mottled horizon below.
C ₁₁	24-36"	Fine sandy loam with considerable grit and fragments. Slightly firm. Structureless. Diffuse pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) mottling against a general background of light gray (10YR 7/2) and very pale brown (10YR 7/3 to 8/3). When moist, the mottles are brown (10YR 5/3) to yellowish brown (10YR 5/4), and the background is pale brown (10YR 6/3) to very pale brown (10YR 7/3). Mottles affect about 50 percent of the volume.
C ₁₂	36-54"	Very fine sandy loam that is rather sharply mottled with brown and yellowish brown (moist). Firm and massive. A coarse skeleton of gneiss cobbles and gravel.
C ₂	54-72"	Light gray (10YR 7/2 to 2.5Y 7/2) sandy loam; grayish brown (10YR 5/2) moist. Slightly firm. Occasional mottling. Partially decomposed gneiss fragments constitute 10-15% of the skeleton.

Acton stony loam

Tolland Co., Connecticut

S43Conn 7-4-1 to 7-4-6

Lab. Nos. 50402 to 50407

Depth Inches	Horizon	M.E./100 Grams Soil						pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+			Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-4	A ₁	1.3	0.5	0.5	0.1	39.2	41.6	4.2	8.0	7.0	12.6	32.0	15.4	21.3	9.4	10.0	4.9
4-13	B ₂₁	0.2	<0.1	0.1	<0.1	12.8	13.1	4.8	1.58	5.6	13.0	36.1	15.2	18.2	9.2	10.8	4.9
13-24	B ₂₂	0.2	<0.1	0.1	<0.1	8.1	8.4	4.7	0.63	4.9	16.1	42.9	15.5	16.2	7.4	9.2	3.9
24-36	C ₁₁	0.8	0.1	<0.1	<0.1	2.0	2.9	5.4	0.69	3.9	9.1	25.5	18.4	25.1	11.0	11.2	4.9
36-54	C ₁₂	3.1	0.7	0.1	0.1	2.2	6.2	6.0	0.60	9.0	16.0	34.8	14.9	16.4	7.7	10.3	6.9
54-72+	C ₂	1.2	0.2	<0.1	<0.1	1.0	2.4	6.1	0.04	2.6	5.5	14.9	16.2	31.7	12.8	13.7	8.1

Underwood stony gravelly loam--Brown Forest

Collectors: Kilmer, Leighty, Roberts, and Wheeting, June 2, 1950, 9:00 a.m. to 12:00 noon.

Location: Klickitat County, Washington, SE cor. Sec. 14, T. 5 N., R. 17E., or 9 miles east and 8 miles north of Goldendale. Sample collected under a ponderosa pine. Sample was easy to collect.

Elevation: 2,500 feet.

Relief: Sloping hillside, 10 percent slope. Some basaltic rocks on the surface. Definite evidence of erosion, both sheet and gully.

Vegetation: Dominantly western yellow pine (ponderosa pine) and Gray oak, with understory of bitterbrush and snowbrush (sticky laurel); many open area occupied by lupine and grass. One ponderosa pine 26 inches in diameter was 175 years old. Most of the trees are approximately 40 feet apart. Typical oak trees are approximately 14 inches in diameter and 25 or 30 feet high. Some old tree stumps.

Drainage: Well drained; moderate to rapid internal drainage; fairly slow infiltration; rapid permeability. There appears to be some surface runoff as indicated by considerable sheet erosion.

Parent material and age: Soils derived from basaltic rock residuum. This appears to be an old landscape. Quartzite gravel on the immediate surface would indicate stream deposition in past geologic time.

Biological activity: Many ants in old root stumps. Considerable black and orange lichens on exposed rocks. Some moss on tree trunks. No worms observed in the profile.

Climate: At Goldendale, Washington, which is approximately 900 feet lower in elevation, probably slightly warmer, and slightly drier, the January average temperature is 29.8°F., the July average is 68.1°F., and the growing season is 140 days. Here the mean annual precipitation for a 34-year period is 16.26 inches, divided as follows: January 2.92, February 1.83, March 1.35, April .80, May .83, June .63, July .19, August .29, September .67, October 1.17, November 2.69, and December 2.89. The average annual snowfall is 26.7 inches. Temperature in shade when sample was collected was 66°F.; at 3 inches below surface temperature was 60°F.; and 55°F. at a depth of 27 inches.

Profile: S50-Wn-20-1

S50-Wn-20-1-1

A ₀	1/2-0"	Loose mat of very dark brown pine needles; very slight decomposition; pH 5.0. Rests directly on:
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S50-Wn-20-1-2

A ₁	0-3"	Brown (7.5YR 5/3), slightly hard, weak fine-granular, stony gravelly loam with some mycelia along roots; dark brown. (7.5YR 3/2) and very friable when moist; nonsticky and non-plastic. Stable to very stable aggregates in water. pH 6.6 at 2 inches. This horizon has approximately 5 to 8 percent of iron and mananese concretions. Gradual change to:
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S50-Wn-20-1-3

B ₁	3-10"	Brown (7.5YR 5/4) to reddish-brown (5YR 5/4), slightly hard, moderate fine-granular, gravelly loam which is slightly heavier than the A ₁ ; dark reddish-brown (5YR 3/4) and friable when moist; slightly plastic. Considerable shot; stable aggregates in water. pH 6.8 at 5 inches, 6.6 at 8 inches. Gradual change to:
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S50-Wn-20-1-4

B₂₁ 10-16"

Not so bright colored as B₁ but slightly more clayey. Brown (7.5YR 5/4), hard, weak, medium subangular blocky, stony slightly gravelly, fine-textured loam with a very few faint fine light brownish-gray splotches; considerable shot. Dark reddish-brown (5YR 3/4) and firm to friable when moist. Slightly sticky and slightly plastic. Moderately stable aggregates in water. pH 6.4.

S50-Wn-20-1-5

B₂₂ 16-20"

Similar to B₂₁ but very slightly less reddish and more clayey; considerable shot or very fine pebbles; pH 6.0.

S50-Wn-20-1-6

B₃ 20-27"

Brown (7.5YR 5/3), hard, weak subangular blocky, fine-textured loam or light clay loam containing a few iron concretions; many soft basalt fragments, and lots of unweathered minerals. Dark brown (7.5YR 5/4) when moist. pH 6.0. More sticky than layer above, but appears to be less weathered and to have less kaolinitic clay. Grades into:

S50-Wn-20-1-7

C₁ 27-36"

Mixture of brown (7YR 5/3), very gravelly sandy loam and brown-coated basaltic rocks, many of them angular. pH 6.0.

Roots are fairly evenly distributed throughout the entire profile.

(Brown Forest)

Klickitat Co., Washington

Underwood stony graveley loam

Lab. Nos. 501072 to 078

S50Wn 2C-1-1 to 1-7

Depth Inches	Horizon	M.E./100 Grams Soil						pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+			Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1-0	A ₀	--	--	--	--	--	--	4.4	22.9	--	--	--	--	--	--	--	
0-3	A ₁	10.2	2.8	1.8	0.1	11.2	26.1	6.2	1.85	9.3	19.9	37.9	13.6	15.7	9.7	7.8	6.0
3-10	B ₁	8.7	1.8	1.1	0.1	7.2	18.9	6.2	0.56	11.5	20.9	38.9	13.6	16.8	9.0	5.8	4.4
10-16	B ₂₁	7.7	2.3	0.8	0.1	6.8	17.7	6.0	0.34	12.3	21.3	39.6	14.0	17.2	7.7	5.2	4.0
16-20	B ₂₂	8.1	2.8	0.8	0.1	6.7	18.5	6.0	0.31	12.9	21.7	41.0	14.0	17.6	6.4	4.8	3.3
20-27	B ₃	7.7	2.7	0.8	0.1	6.7	18.0	6.0	0.25	13.0	21.5	40.6	14.4	18.0	6.3	4.2	3.5
27-36+	C ₁	11.7	4.4	1.4	0.2	8.3	26.0	6.2	0.35	9.3	15.4	27.6	13.7	20.1	7.7	9.5	12.1

Underwood loam--Brown Forest

Collectors: Kilmer, Leighty, Roberts, and Wheeting, June 2, 1950, 2:00 p.m. to 5:00 p.m.

Location: Klickitat County, Washington, NW 1/4 SW 1/4 Sec. 9, T. 5 N., R. 17 E., or 7 miles east and 9 miles north of Goldendale. Sample collected on east side of U. S. Highway 97, approximately 2 1/2 miles northwest of sample of Underwood stony gravelly loam. Sample collected under a large ponderosa pine.

Elevation: Approximately 2,600 feet.

Relief: Nearly level to sloping ridge top, approximately 10 percent slope. Very few or no stones observed on the surface. In the vicinity some quartz cobbles and gravel appear on the surface. Very little evidence of erosion where the sample was collected, but erosion is moderate to severe in the vicinity on slopes exceeding 8 percent.

Vegetation: This is cut-over land with second-growth timber, dominantly ponderosa pine with an undercover of snowbrush (sticky laurel), bitterbrush, and wildrose, with vetch and cheatgrass in the more open areas. Pine trees are approximately 20 feet apart, 28 inches in diameter, 100 years old. Some of the trees were 14 inches in diameter and 35 years old. This area had been burnt over some time ago. In places burnt roots were observed at a depth of 12 to 14 inches. Approximately 15 to 20 percent of the area is open and not covered by trees.

Drainage: Well drained. Moderate to rapid internal drainage. Fairly slow infiltration. Rapid permeability. There appears to be some surface runoff as indicated by considerable sheet erosion.

Parent material: Soil has developed from basic rocks, dominantly basalt. Some quartzite gravel in the vicinity, but this has had little or no influence on the soil profile. In general on the steeper slopes of 15 percent or more the soils are very rocky; the profile is shallow; the soil is redder, and not so heavy textured. On the slopes at the base of hills where there appears to be deposition, soils are heavier textured, yellower or browner in color, and are generally 4 feet or more to basalt bedrock.

Biological activity: Considerable fungal mycelia. Some ants and other insects. No angle worms.

Climate: At Goldendale, which is 1,000 feet lower in elevation and is probably slightly warmer and has slightly less precipitation, the January average temperature is 29.8°F., the July average is 68.1°F., and the growing season is 140 days. The mean annual precipitation for a 34-year period is 16.26 inches, divided as follows: January 2.92, February 1.83, March 1.35, April .80, May .83, June .63, July .19, August .29, September .67, October 1.17, November 2.69, December 2.89. The average annual snowfall is 26.7 inches. The temperature in shade when sample was collected was 66°F., 60°F. at 3 inches below surface, and 55°F. at a depth of 27 inches.

Profile: S50-Wn-20-2

S50-Wn-20-2-1

A₀ 1/4-0" Loose leaf mat of partially decomposed western yellow pine needles. pH 5.0. Rests directly on:

S50-Wn-20-2-2

A₁ 0-3" Dark brown to brown (7.5YR 4/3), weak fine-granular, gritty loam with approximately 6 percent shot and some fine gravel; very dark brown (7.5YR 2/2) and very friable when moist; slightly plastic; pH 6.0.

S50-Wn-20-2-3

B₁ 3-7" Brown (7.5YR 5/4), weakly fine-granular, gravelly loam containing approximately 20 percent gravel greater than 2 mm.; dark reddish brown (5YR 3/3) and friable when moist; slightly plastic. pH 6.0. Grades into:

S50-Wn-20-2-4

B₂₁ 7-12" Similar to B₁ except slightly redder, heavier, and more plastic; brown (7.5YR 5/4) to reddish-brown (5YR 4/3), weak fine-granular, slightly gravelly loam; dark reddish brown (5YR 3/3) and friable when moist. Stable aggregates in water. pH 6.2.

S50-Wn-20-2-5

B₂₂ 12-19" Browner than B₂₁; brown (7.5YR 5/4), hard, weak fine-granular, loam with a slight amount of gravel. Dark reddish brown (5YR 3/3) and friable when moist. Moderately stable aggregates in water. pH 6.5.

S50-Wn-20-2-6

B₃ 19-29" Somewhat variegated brown (7.5YR 5/4) and reddish-brown (5YR 5/4), hard, weak medium subangular, blocky, slightly gritty light clay loam or heavy loam which is firm to brittle with many small pin-size holes; some very dark gray stains. Dark reddish brown (5YR 3/3) when moist. Moderately stable aggregates in water; pH 6.5. This horizon has many sharp angular 1/8-inch basalt fragments.

S50-Wn-20-2-7

C₁ 29-46" Brown (7.5YR 5/4), hard, weak medium subangular, blocky, light clay loam containing many small, angular basalt fragments. Few distinct medium pinkish-gray splotches, and many distinct, fine, very dark gray stains; dark reddish brown (5YR 3/3), firm, or brittle when moist. Sticky and plastic. Very few roots. pH 6.6. Grades into:

S50-Wn-20-2-8

C₂ 46-80"+ Similar to C₁ but more massive and not so many very fine pebbles or shot.

Roots are definitely not concentrated in the upper horizons but are fairly evenly distributed from 5 to 30 inches, decreasing rapidly below 30 inches.

Underwood loam

Klickitat Co., Washington

(Brown Forest)

S50Wn-20-2-1 to 2-8

Lab. Nos. 501079 to 1086

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S +				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1/4-0	A ₀	--	--	--	--	--	--	--	4.1	32.6	--	--	--	--	--	--	--	
0-3	A ₁	6.5	1.5	1.6	0.1	13.3	23.0	42	5.9	1.95	9.0	20.3	37.1	12.3	14.9	10.1	9.6	7.0
3-7	B ₁	6.0	1.0	1.3	0.1	11.3	19.7	43	6.0	0.98	8.9	20.0	36.1	13.2	15.9	10.8	10.1	5.0
7-12	B ₂₁	5.6	1.7	1.2	0.1	9.0	17.6	49	5.9	0.59	10.3	19.7	35.6	12.2	16.4	9.8	9.2	6.5
12-19	B ₂₂	7.2	2.2	1.2	0.1	7.7	18.4	58	6.0	0.34	14.2	18.3	33.3	13.4	18.0	8.5	7.4	5.2
19-29	B ₃	7.0	2.6	1.1	0.1	7.0	17.8	61	6.2	0.23	18.1	17.0	30.8	13.8	18.1	7.5	6.4	5.3
29-46	C ₁	6.8	2.7	0.8	0.1	7.0	17.4	60	6.2	0.12	18.2	16.3	30.4	14.7	19.6	8.0	6.1	3.0
46-84	C ₂	8.0	3.2	0.6	0.2	5.7	17.7	68	6.0	0.13	21.7	20.6	36.3	14.8	14.2	5.6	4.6	2.8

Roslyn fine sandy loam--Brown Forest

Collectors: Kilmer, Leighty, Roberts, and Wheeting, June 3, 1950, 2:00 to 4:00 p.m. Sample very easy to dig.

Location: Kittitas County, Washington, NW corner Sec. 33, T. 20 N., R. 15 E., or 1 1/2 miles west of South Cle Elum. Sample collected south of the old highway, under ponderosa pine.

Elevation: Approximately 2,250 feet.

Relief: Nearly level old terrace. Approximately 1 percent slope.

Vegetation: Cut-over forest, dominantly western yellow pine and a few Douglas-fir. Understory of Oregon grape and snowberry, with vetch, lupine, and grass in the open areas. One pine tree 16 inches in diameter, 45 years old. Fir tree 17 inches in diameter, 62 years old. Lots of pine reproduction. Trees often about 10 in a cluster with 15 to 35 feet between clusters. Lots of open areas.

Drainage: Well to somewhat excessively drained. Rapid internal drainage. Rapid infiltration. Rapid to very rapid permeability.

Parent material: Mixed old glacial outwash fan material. Rocks are dominantly basaltic; some granite, sandstone, and andesite; and some are metamorphic. Many are cobblestones 5 inches in diameter. Most of them are either flat or rounded.

Biological activity: Very little biological activity. Some ants, no worms or worm casts, but considerable fungi.

Climate: At Cle Elum, which is approximately 300 feet lower in elevation, but which has practically the same climate, the January average temperature is 26.7°F., the July average is 64.6°F., and the growing season is 107 days. Mean annual precipitation for a 39-year period is 23.05 inches, divided as follows: January 3.93, February 2.58, March 2.38, April 1.05, May .96, June .87, July .34, August .33, September .88, October 1.77, November 3.62, and December 4.34. Average annual snowfall is 86.3 inches. Air temperature in shade at 2:00 p.m., when sample was being collected, was 66°F., 55°F. at 3 inches below surface, and 45°F. at 50 inches below the surface.

Profile: S50-Wn-19-1

S50-Wn-19-1-1

A₀ 1-0" Loose mat of slightly decomposed pine needles over a loose, fluffy, strongly decomposed organic mat (H layer); pH 5.0. Considerable fungi. Abrupt change to:

S50-Wn-19-1-2

A₁ 0-2" Dark grayish-brown (10YR 4/2), weak fine-granular, fine sandy loam or loam; few pebbles; very dark brown (10YR 2/2) and very friable when moist; very slightly plastic; very stable aggregates in water; pH 5.6. Abrupt change to:

S50-Wn-19-1-3

AB 2-7" Brown (10YR 5/3), weakly fine-granular, fine sandy loam or loam; few pebbles; very dark grayish brown (10YR 3/2) and friable when moist; slightly plastic; stable aggregates in water; pH 5.9. Gradual change to:

S50-Wn-19-1-4

B₁ 7-18" Brown (7.5YR 5/3), very weak medium subangular, blocky, light loam that crushes to fine granules; few rounded and subangular pebbles; dark-brown (7.5YR 3/3) and friable when moist; slightly plastic; stable aggregates in water; pH 5.9. Fairly abrupt change to:

S50-Wn-19-1-5

B₂₁ 18-28" Brown (7.5YR 5/3), hard, weak medium subangular, blocky, clay loam or fine-textured loam with very few pebbles; dark brown (7.5YR 3.5/3) and friable when moist; moderately plastic; moderately stable aggregates in water; pH 6.0. Gradual change to:

S50-Wn-19-1-6

B₂₂ 28-41" Similar to layer above, but very slightly browner and more clayey. Brown (7.5YR 5/3), hard, weak medium subangular, blocky, coarse-textured clay loam or fine-textured loam that is slightly gritty and contains very few pebbles; dark brown (7.5YR 4/3) and friable when moist; pH 6.1. Rather abrupt change to:

S50-Wn-19-1-7

B₃ 41-54" Yellowish-brown (10YR 5/4), massive or single-grain, cobbly gravelly loam; dark brown (10YR 4/3) and slightly plastic when wet; 35 percent or more of the soil by weight consists of pebbles 2 to 3 inches in diameter; pH 6.1. Almost all roots stop at the top of this gravelly layer. Grades into:

S50-Wn-19-1-8*

C 54-60" + Light yellowish-brown (10YR 6/4), loose, single-grain, very gravelly loamy coarse sand with cobblestones 5 inches in diameter; pebbles coated light yellowish brown; dark yellowish brown (10YR 4/4) when moist; pH 6.1.

Roots are fairly well distributed from 0 to 40 inches, but greatest concentration is between 15 and 30 inches. All layers have some rocks, which are larger and more numerous with depth.

Roslyn fine sandy loam

Kittitas Co., Washington

(Brown Forest)

S50Wn-19-1-1 to 1-8

Lab. Nos. 501087 to 1094

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	PH	% O.C.	Size Classes %						
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	VCS
1-0	A ₀	--	--	--	--	--	--	--	4.6	47.8	--	--	--	--	--	--	--
0-2	A ₁	12.7	2.4	0.8	0.1	18.8	34.8	46	5.5	6.4	10.6	19.4	37.4	10.8	22.7	9.3	5.9
2-7	AB	7.8	1.4	0.8	0.1	12.0	22.1	46	5.7	2.08	8.8	18.4	34.6	11.2	24.8	9.6	5.8
7-18	B ₁	6.6	1.4	0.9	0.1	5.7	14.7	61	5.8	0.86	11.3	20.6	39.7	13.7	17.7	8.2	5.3
18-28	B ₂₁	7.6	2.2	0.6	0.2	7.2	17.8	60	5.8	0.40	13.3	22.1	43.8	14.6	14.5	6.3	4.5
28-41	B ₂₂	6.9	3.1	0.3	0.2	7.2	17.7	59	5.9	0.41	13.5	21.4	43.2	14.4	13.9	6.3	5.0
41-54	B ₃	6.7	3.7	0.2	0.2	7.0	17.8	61	6.0	0.28	12.7	16.5	29.9	10.7	13.9	9.4	13.4
54-60	C	5.4	2.5	0.2	0.2	5.8	14.1	59	6.0	0.19	7.5	9.8	15.7	7.8	14.9	12.6	24.0

Roslyn fine sandy loam--Brown Forest

Collectors: Kilmer, Leighty, Roberts, and Wheeting, June 3, 1950, 4:30 p.m. to 6:45 p.m. Sample very easy to collect.

Location: Kittitas County, Washington, approximately center of Sec. 5, T. 19 N., R. 15 E., 3 miles southwest of South Cle Elum, Washington. Sample collected under western yellow pine with Douglas-fir close by.

Elevation: 2,400 feet.

Relief: Gently sloping terrace, approximately 2 per cent slope.

Vegetation: Approximately 50 percent Douglas-fir and 50 percent ponderosa pine with some vine maple. Understory consists of Oregon grape, wild strawberries, vetch, wild currant, some grass and dandelions. Very little green moss on trees. Very good reproduction of ponderosa pine and Douglas-fir. This area has been cut over, and at the present time there is considerable grass. It is easy to walk through the forest, since there are very few fallen trees and decaying logs. Pine trees 6 inches in diameter are 30 years old, and Douglas-fir trees 12 inches in diameter are the same age. Large trees approximately 50 feet apart with several small ones in between. Older trees 60 to 125 feet high.

Drainage: Well to somewhat excessively drained; rapid internal drainage; rapid infiltration; rapid permeability with little or no runoff and no erosion.

Parent material: Old glacial outwash fan or terrace; mixed material, dominantly basic and granitic, some diorite and schist material.

Biological activity: Some ants and much fungi in the upper part of the profile. No worms.

Climate: At Cle Elum, which is 500 feet lower in elevation and which would have less precipitation and snowfall than at sample site, the January average temperature is 26.7°F., the July average is 64.6°F., and the average growing season is 107 days. The mean annual precipitation for a 39-year period is 23.05 inches, divided as follows: January 3.93, February 2.58, March 2.38, April 1.05, May .96, June .87, July .34, August .33, September .88, October 1.77, November 3.62, and December 4.34. The average annual snowfall is 86.3 inches. At 4:30 p.m. at the sample site the air temperature was 80°F. in the shade, temperature was 50°F. at 3 inches below the surface, and 45° at 50 inches.

Profile: S50-Wn-19-2

S50-Wn-19-2-1

A₀ 2-0" Loose leaf mat of very dark grayish-brown or very dark brown partly decomposed needles and leaves with much mycelia; pH in upper part 5.8, in lower part 6.8. Abrupt change to:

S50-Wn-19-2-2

A₁ 0-3" Dark grayish-brown (10YR 4/2) to grayish-brown (10YR 5/2), weak fine-granular, fine sandy loam; very dark grayish-brown (10YR 3/2) to very dark brown (7.5YR 2/2) and friable when moist; very slightly plastic; very few shot or very fine gravel; pH 6.2. Rather abrupt change to:

S50-Wn-19-2-3

AB 3-7" Brown (10YR 5/3), slightly hard, fine-granular, fine sandy loam with approximately 8 percent shot or iron- and manganese-coated fine gravel; dark brown (7.5YR 3/2) and friable when moist; very slightly plastic; pH 6.0. Rather abrupt change to:

S50-Wn-19-2-4

B₁ 7-14" Brown (7.5YR 5/3), slightly hard, weak coarse-granular to very weak medium subangular, blocky, loam containing few shot and pebbles; when moist, dark brown (7.5YR 4/3), friable, and crumbles readily between the fingers to fine granules; slightly plastic; pH 6.0. Fairly abrupt change to:

S50-Wn-19-2-5

B₂₁ 14-26" Brown (7.5YR 5/4), hard, distinctly medium and coarse subangular, blocky, clay loam or fine-textured loam; dark brown (7.5YR 4/4) and firm when moist; plastic; few pebbles; pH 5.8. Some of the peds have polished sides. In places there are few faint medium light brownish-gray splotches. Material much more difficult to crush between the fingers than layer above, but soil digs easily. Gradual change to:

S50-Wn-19-2-6

B₂₂ 26-41" Brown (7.5YR 5/4) to yellowish-brown (10YR 5/4), hard, weak to moderate medium subangular, blocky, clay loam or fine-textured loam with few faint reddish-brown and dark-brown coatings and very few faint, fine, light brownish-gray splotches; appears to be somewhat brittle; some pinheadsized holes; few pebbles; dark brown (7.5YR 4/3) and friable to firm when moist; moderately plastic and slightly sticky; pH 5.8. Grades into:

S50-Wn-19-2-7

B₃ 41-58" Yellowish-brown (10YR 5/4), hard, massive to weak medium subangular, blocky, clay loam or fine-textured loam with few fine, dark-brown manganese stains on aggregates and very few faint, light brownish-gray splotches; dark yellowish-brown (10YR 4/4) to dark brown (7.5YR 4/3) and friable when moist; plastic and slightly sticky; considerable decomposed pebbles; very few or no shot; pH 6.0.

S50-Wn-19-2-8

C₁ 58-66" Yellowish-brown (10YR 5/4), very gravelly loam with brownish-yellow coating on the pebbles; dark yellowish-brown (10YR 4/4), slightly sticky, and slightly plastic when wet; pH 6.4.

S50-Wn-19-2-9*

C₂ 66-72" Nearly loose, single-grain, very gravelly loamy sand; pebbles coated light yellowish-brown; pH 6.6.

Roots are fairly evenly distributed throughout the profile. Appear to be healthy and large in diameter. Some of those near the surface run parallel. The mycelia are very noticeable in this profile, especially in the A₁ and AB horizons and even in the B₁ and B₂ horizons. Many fine roots are in the B₂ horizon.

Remarks: In areas of Roslyn fine sandy loam mapped east of Cle Elum where the rainfall is less, the vegetation is definitely more open and consists of ponderosa pine with an understory of bitterbrush and balsamroot. Dominant crops grown on Roslyn fine sandy loam are alfalfa, peas, and grain. This soil is fairly productive, and farmers choose it in preference to some of the other soils for clearing and cultivating.

Roslyn fine sandy loam

Kittitas Co., Washington

S50In-19-2-1 to 2-9

Lab. Nos. 501095 to 1103

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %						CS	VCS
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS		
2-0	A ₀	--	--	--	--	--	--	--	4.8	36.8	--	--	--	--	--	--	--	--
0-3	A ₁	10.0	1.6	1.1	0.1	15.8	28.6	45	5.5	3.04	10.5	23.3	37.0	8.2	26.7	11.0	4.8	1.8
3-7	AB	4.8	1.1	0.9	0.1	14.8	21.7	32	5.3	1.41	10.1	23.3	39.4	9.1	22.8	10.6	5.2	2.8
7-14	B ₁	6.2	1.1	0.8	0.1	10.2	18.4	44	5.6	0.50	11.5	24.7	45.5	12.5	16.2	8.5	3.9	1.9
14-26	B ₂₁	8.1	1.6	0.4	0.1	7.3	17.5	58	5.8	0.17	17.7	22.4	47.1	13.0	11.7	6.0	2.5	2.0
26-41	B ₂₂	9.5	1.0	0.3	0.2	7.7	18.7	59	5.8	0.17	19.7	23.3	47.8	12.6	10.8	5.9	1.9	1.3
41-58	B ₃	10.0	2.4	0.2	0.3	8.0	20.9	62	6.0	0.19	17.8	23.2	48.1	14.1	10.6	4.8	2.4	2.2
58-66	C ₁	10.7	3.5	0.2	0.3	8.0	22.7	65	6.2	0.18	10.2	18.4	35.2	10.6	12.0	8.6	11.6	11.8
66-72	C ₂	8.0	2.7	0.2	0.3	5.7	16.9	66	6.4	0.11	5.1	8.1	14.5	6.6	17.2	14.0	22.8	19.8

Saikum silty clay loam

Collectors: Kilmer, Leighty, Roberts, and Wheeting, June 5, 1950, 2:30 p.m. to 5:30 p.m.

Location: Lewis County, Washington, SW 1/4, NW 1/4, Sec. 25, T. 12 N., R. 2 W., or about 2-1/2 miles east of Winlock. Sample collected under group of Douglas-firs.

Elevation: 600 feet.

Relief: Gently undulating, very old terrace; approximately 3 percent slope.

Vegetation: Dominantly Douglas-fir, cedar, and some dogwood, alder, and broadleaf maple (Oregon maple) with an understory of wood fern, salmonberry, Oregon grape, and in places, salal. One fir tree 17 inches in diameter, 86 years old, approximately 200 feet high. Many of the Douglas-fir 25 feet apart with dogwood and alder in between. One fir tree 24 inches in diameter and 100 years old. In the vicinity there are many trees 30 inches in diameter and 30 feet apart. Lots of fallen logs. Fairly difficult to penetrate forest.

Drainage: Well drained. Very little surface runoff, moderate internal drainage, rapid infiltration, moderate to rapid permeability. Very little if any erosion.

Parent material: Mixed rocks, dominantly basic. A very old formation, probably old glacial drift. Unable to determine whether it was glacial outwash or glacial till. Probably formed from Cascade glaciation. Rocks to a very low depth are soft, and can be easily cut with a knife or spade. They still retain, however, their original rounded and flat shape.

Biological activity: A few angle worms and centipedes; some bugs, but very few ants. Considerable fungal mycelia in the A₁ and A₃ horizons.

Climate: At Centralia, which is approximately 400 feet lower in elevation, the January average temperature is 38.5, July average is 64.0° F., and the growing season is 173 days. Mean annual precipitation for a 37-year period is 45.64 inches divided as follows: January 6.59, February 5.02, March 4.81, April 2.85, May 2.37, June 1.92, July .60, August .97, September 2.16, October 3.65, November 7.19, December 7.51. Average snowfall is 11 inches. The precipitation where sample was collected probably slightly exceeds that at Centralia. The temperature and growing period should be approximately the same. Air temperature in the shade at sample site at 5:00 p.m. was 57° F., at 3 inches below the surface 52° F., and at 40 inches below the surface 48° F.

Profile: S50-Wn-21-1

S50-Wn-21-1-1

A ₀	1-0"	Loose or very friable leaf mat of very dark brown, partly decomposed needles, wood, and moss; pH 5.8. Very abrupt change to:
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S50-Wn-21-1-2

A ₁	0-4"	Dark grayish-brown (10YR 4/2), hard, friable, heavy silt loam or light silty clay loam with very water-stable, distinct, medium- and coarse-granular aggregates; very dark brown (10YR 2/2), slightly sticky, and slightly plastic when moist. Roots are large and very numerous. pH 6.0 at 1 inch, 5.8 at 3.5 inches. This horizon is very wavy and changes abruptly to:
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S50-Wn-21-1-3

A ₃	4-11"	Brown (9YR 4.5/3), hard, moderate to strong medium- and fine-granular silty clay loam or fine-textured silt loam with few firmer, very fine peds or concretions; peds very stable in water; dark brown (7.5YR 3/3), sticky, and moderately plastic when wet; numerous large roots; considerable mycelia; pH 5.6 at 5 inches, 5.2 at 10 inches. Gradual change to:
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S50-Wn-21-1-4

B₁ 11-18" Brown (7.5YR 5/3), hard, friable silty clay loam; large water-stable granules or medium and fine subangular, blocky aggregates; dark brown (7.5YR 4/3 to 3/2), sticky, and moderately plastic when wet. Some worm casts in nests. Some mixing of A₃ and B₂₁ horizons. Few small hard pebbles and some fine shot or concretions. Considerable roots but less than layer above. Rather abrupt change to layer below, especially in content of roots. Almost a root mat at top of B₂₁, which is much higher in manganese. pH 4.9-5.2.

S50-Wn-21-1-5

B₂₁ 18-29" Brown (7.5YR 5/4), very hard, silty clay loam that is very pale to pale brown to light brown when cut; dark brown to brown (7.5YR 4/3), sticky, and plastic when wet. This is the most compact layer in the profile. Solid color. Has some hard and soft black manganese concretions and stains. Many of the structural units are subangular blocky and 1 inch in diameter but readily break into smaller units less than 1/16-inch in diameter; peds moderately stable in water. pH 4.8. Very few roots. Some soft gravel. Wavy boundary between this layer and layer below.

S50-Wn-21-1-6

B_{22cn} 29-48" Zone of manganese concretions, large 1 to 1-1/4 inch black splotches and angular concretions. Brown (7.5YR 5/3), very hard, moderate to strong medium and fine subangular, blocky, fine-textured, silty clay loam with some 7.5YR 5/4 coating on peds and some red or yellowish-red mottling, streaks, and splotches; very pale brown to light yellowish-brown to light brown when cut; only slightly darker when moist; sticky and plastic; firm and cloddy; some strong-brown, yellowish-red, and red 1-mm. concretions; pH 4.8. Grades into:

S50-Wn-21-1-7*

C 48-64" Mottled brown (10YR 5/3 to 7.5YR 5/4), light-gray to light brownish-gray (10YR 6/1.5), red (2.5YR 4/6), and dark-red (2.5YR 3/6), very hard clay or silty clay loam with many soft pebbles and some cobblestones; when wet, sticky, plastic, and mottled brown (7.5YR 4/3), gray to grayish brown (10YR 5/1.5), dark red (2.5YR 3/6), and weak red (10R 4/4); some concretions as in B₂₂ cn; pH 5.6. Very few roots. The soil is more plastic and heavier textured with depth.

Lab. Nos. 501104 to 1110

S50/n-21-1-1 to 1-7																		
Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1-0	A ₁	--	--	--	--	--	--	--	5.4	--	--	--	--	--	--	--	--	--
0-4	A ₁	13.8	2.8	0.6	0.3	24.3	41.8	42	5.6	5.60	36.0	36.9	53.4	3.5	3.4	1.5	1.7	0.5
4-11	A ₃	5.2	1.5	0.3	0.2	22.0	29.2	25	5.2	2.47	40.4	34.0	50.2	3.2	2.8	1.3	1.6	0.5
11-18	B ₁	1.2	1.0	0.2	0.1	19.1	21.6	12	5.0	1.13	42.8	33.6	48.3	3.2	2.7	1.2	1.5	0.3
18-29	B ₂₁	0.8	0.8	0.2	0.1	16.6	18.5	10	4.7	0.43	55.8	26.3	37.2	2.6	2.1	1.0	1.0	0.3
29-48	B _{22on}	0.9	0.8	0.2	0.1	17.5	19.5	10	4.8	0.34	55.9	25.6	36.4	2.9	2.2	0.9	1.1	0.6
48-64	C	4.8	2.6	0.1	0.3	12.3	20.1	39	5.2	0.10	58.4	22.9	31.8	3.8	2.7	1.1	1.3	0.9

Salkum silty clay loam

Collectors: Kilmer, Leighty, Roberts, and Wheeting, June 6, 1950, 9:00 a.m. to 11:30 a.m.

Location: Lewis County, Washington, SW 1/4 NW 1/4, Sec. 16, T. 12 N., R. 1 W., or the northwest part of the Lewis and Clark State Park. Sample collected a short distance east of U. S. Highway 99. Sample collected in virgin area of Douglas-fir and cedar.

Elevation: 650 feet.

Relief: Gently sloping old terrace, 8 percent slope. Some cradle knolls.

Vegetation: Dominantly Douglas-fir and cedar with an undergrowth of ferns, salal, dogwood, and few vine maple. Some moss, but little or no grass in the dense woods. Some tree lichens on the firs. Lots of rotten logs. Trees 6 to 15 feet apart, and there are some large old trees which were cut years ago. One old fir tree 30 inches in diameter, 140 years old, and 200 feet high. Typical cedar 14 inches in diameter, 55 years old, and 80 feet high.

Drainage: Well drained; very little surface runoff, moderate internal drainage, rapid infiltration, moderately rapid permeability. Little or no erosion.

Parent material: Mixed rocks, dominantly basic. A very old formation, probably old glacial drift. Unable to determine whether it was glacial outwash or glacial till. Probably formed from Cascade glaciation. Rocks to a very low depth are soft and can be easily cut with a knife or spade. They still retain, however, their original rounded and flat shape.

Biological activity: Some angle worms, centipedes, and considerable mycelia.

Climate: At Centralia, Washington, which is approximately 400 feet lower in elevation and about 18 miles north of sample site, the January average temperature is 38.5, July average is 64.0° F., and the growing season is 173 days. Mean annual precipitation for a 37-year period is 45.64 inches, divided as follows: January 6.59, February 5.02, March 4.81, April 2.85, May 2.37, June 1.92, July .60, August .97, September 2.16, October 3.65, November 7.19, and December 7.51. Average snowfall is 11 inches. Temperature at sample site when sample was collected was 54° in the shade, 50° at 3 inches below the surface of the soil, and 45° at 40 inches.

Profile: S50-Wn-21-2

S50-Wn-21-2-1

A₀ 1/2-0"

Nearly loose or very friable root mat, dominantly very dark brown, moderately decomposed Douglas-fir needles and wood with mixture of moss; pH 4.5. Boundary between A₀ and A₁ is abrupt but wavy.

S50-Wn-21-2-2

A₁ 0-3"

Brown (9YR 5/3) to dark grayish-brown (10YR 4/2), hard, medium- and coarse-granular, slightly plastic, heavy silt loam; some shot or dark-brown, strong-brown, reddish-brown, and red concretions 1 to 2 mm. across; granules distinct, but weaker than layer below; finer granular in top 1 inch; dark-brown (7.5YR 3/2) when moist; pH 5.6 at 1/2 inch, 5.8 at 1.5 inches. Boundary between this layer and layer below is wavy and gradual.

S50-Wn-21-2-3

A₃ 3-9"
(or
B₁)

Brown to light-brown (7.5YR 5.5/3), very hard silty clay loam; medium subangular, blocky breaking to firm, medium and coarse granules; water stable, some are 1/4-inch in diameter; some shot or concretions 1 to 2 mm. across as in A₁; dark brown to brown (7.5YR 4/2.5), sticky, and slightly plastic when wet. This horizon appears to be the layer of greatest shot content (some may be very firm peds). There is some A₁ material in pockets. pH 6.0 at 4 inches, 6.6 at 8 inches. This horizon is very wavy and gradually grades into layer below.

S50-Wn-21-2-4

B₁ 9-24"
(or
B₂₁)

Light-brown (7.5YR 6/3), very hard to hard, silty clay loam; mostly solid color, but coated brown (7.5YR 5/4) to reddish brown (5YR 4/4); large aggregates appear to be subangular, blocky 1/4 to 1/2 inch in diameter, but they break readily into small granular peds; moderate small shot, concretions, or very firm peds; peds stable in water; when wet, reddish-brown (5YR 4/3) to brown (7.5YR 4/4), coated dark reddish-brown (5YR 3/4), sticky, and moderately plastic; roots numerous; pH 6.6. Gradual change to:

S50-Wn-21-2-5

B₂₁ 24-35"

Similar color when wet to horizon above, but more plastic and more sticky, and appears to have slightly more clay content; when dry, slightly lighter colored than B₁ and less brown to reddish-brown coating; few, small, very dark gray manganese stains, but fewer other concretions than in above horizon; peds moderately stable in water; pH 6.1. Grades into:

S50-Wn-21-2-6

B₂₂ 35-49"

Very pale brown (10YR 7/4) to pink (7.5YR 7/3) on a cut surface, but much coated with reddish brown (5YR 4/4); heavy silty clay loam that is denser and heavier textured than layer above; firm, very hard to hard aggregates, slightly polished sides; when wet, plastic, sticky, and reddish-brown (5YR 4/4) to brown (7.5YR 5/4) on a cut surface, but coated dark reddish-brown (5YR 3/4); considerable manganese. A few roots. Abrupt change to layer below, but very wavy. Forms almost a root mat at the lower part of this layer; pH of root mat is 5.0.

S50-Wn-21-2-7

C₁₁ 49-71"

Highly mottled reddish-yellow (7.5YR 6/6), strong-brown (7.5YR 5/6), light-gray (10YR 7/1), pale yellow (2.5Y 7/3), and reddish-brown (5YR 4/4), brittle, lumpy silty clay; when wet, highly mottled strong brown, gray, reddish-brown, yellowish-brown, and dark reddish-brown, very sticky, and plastic. Considerable iron concretions; pH 4.8. Grades into:

S50-Wn21-2-8*

C₁₂ 71-100"

Highly mottled white (10YR 8/1) and brownish-yellow (10YR 6/6 and 6/8), hard, massive or weak subangular, blocky, nuciform, cheesy silty clay loam that is more friable and less red than layer above; when wet, sticky, moderately plastic, and highly mottled light gray (10YR 7/1) and strong brown (7.5YR 5/6 and 5/8); pH 4.8. Many soft, partially decomposed pebbles and cobblestones. Rocks appear to be mostly andesitic with very little quartz.

Salkum silty clay loam

Lewis Co., Washington

(Brown Podzolic or Laterite?)

S50/n-21-2-1 to 2-8

Lab. Nos. 501111 to 1118

Depth Inches	Horizon	M.E./100 Grams Soil						% B. Sat	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1/2-0	A ₀	--	--	--	--	--	--	--	4.3	--	--	--	--	--	--	--	--	--
0-3	A ₁	8.0	0.7	0.4	0.1	19.3	28.5	32	5.1	3.55	22.5	44.6	63.0	4.7	4.0	2.0	2.7	1.1
3-9	A ₃	6.7	0.7	0.3	0.1	10.7	18.5	42	5.8	1.04	25.8	43.5	61.3	4.6	3.6	1.8	2.1	0.8
9-24	B ₁	5.4	0.6	0.4	0.1	10.0	16.5	39	6.1	0.50	25.4	41.6	60.9	4.6	3.6	2.0	2.5	1.0
24-35	B ₂₁	5.9	0.9	0.4	0.1	8.4	15.7	46	5.8	0.32	36.0	34.6	52.3	3.8	3.2	1.7	2.0	1.0
35-49	B ₂₂	5.8	1.1	0.4	0.1	11.5	18.9	39	5.2	0.12	54.9	23.9	36.1	3.0	2.4	1.2	1.6	0.8
49-71	C ₁₁	3.3	2.0	0.2	0.2	11.2	16.9	34	4.8	0.07	46.5	27.3	39.8	5.1	3.9	1.5	1.9	1.3
71-100	C ₁₂	3.8	2.3	0.2	0.2	11.0	17.5	37	4.7	0.01	36.8	32.3	44.5	7.1	5.5	2.0	2.4	1.7

Winlock: silty clay loam--"Humic Prairie"

Collectors: Kilmer, Leighty, Roberts, and Wheeting, June 6, 1950, 1:30 p.m. to 4:00 p.m.

Location: Lewis County, Washington, NE 1/4, SE 1/4 Sec. 26, T. 12 N., R. 2 W., or about 2 1/4 miles east of Winlock. This sample is about 1/4 mile from the sample No. S50-Wn-21-1, Salkum silty clay loam. Sample collected in a 50-year old grove of Douglas fir.

Elevation: Approximately 500 feet.

Relief: Gently sloping old terrace, approximately 2 percent slope to the west.

Vegetation: Originally this area was probably in grass. No doubt when the first settlers arrived in Lewis County in about 1838, all the Winlock soils were in prairie, and this area was probably farmed for a number of years, possibly until about 1900 when the trees were allowed to encroach on this farm land. They have grown rather rapidly ever since, and definitely have the appearance of trees growing on prairie--that is, they are branched from within a foot of the ground, yielding lumber that will be very knotty. The bark has quite a different color than bark on the trees growing on the Salkum and other forest soils. It is purplish in color. There is considerable grass, some vetch, and some ferns, with considerable moss on the ground. The trees are fairly evenly spaced, about 30 feet apart and range from 6 to 18 inches in diameter. The older trees are about 120 feet high. Typical 50-year old trees are 14 inches in diameter and 110 feet tall. A tree 4 inches in diameter was 20 years old and 85 feet tall. The soil profile did not show any visible evidence of degradation.

Drainage: Well drained. Very little surface runoff, moderate internal drainage, rapid infiltration, moderately rapid permeability. No evidence of erosion.

Parent material: Mixed rocks, dominantly basic. Some very old formation, probably old glacial drift. Unable to determine whether it was glacial outwash or glacial till. Probably formed from Cascade glaciation. Rocks to a very low depth are soft and can be easily cut with a knife or spade, however, they still retain their original rounded and flat shape.

Biological activity: Angle worms, fungal mycelia, some ants.

Climate: At Centralia, Washington, the January average temperature is 38.5° F., July average is 64.0° F., and the growing season is 173 days. Mean annual precipitation for a 37-year period is 45.64 inches divided as follows: January 6.59, February 5.02, March 4.81, April 2.85, May 2.37, June 1.92, July .60, August .97, September 2.16, October 3.65, November 7.19, and December 7.51. Average snowfall is 11 inches. Air temperature at sample site was 54° F., and at 40 inches below the surface it was 47° F.

Profile: S50-Wn-21-3

S50-Wn-21-3-1

A₀ 1/2-0" Nearly loose or very friable, very dark brown, partially decomposed fir needles, wood, and moss; pH 6.2. Abrupt change to:

S50-Wn-21-3-2

A₁₁ 0-4" Dark grayish-brown (10YR 4/2), strong coarse granular, or fine sub-angular, blocky silty clay loam or fine-textured silt loam with large firm granules that are hard when dry. They break fairly easily into smaller units; no shot. Very dark brown (10YR 2/2), slightly sticky, and slightly plastic when wet. Some mycelia; some worm casts. pH 5.6 at .5 inch, 5.2 at 2 inches. The mycelia appear to be more acid (pH 5.0) than the adjacent soil. Peds are very stable in water.

S50-Wn-21-3-3

A₁₂ 4-11"

Similar to A₁₁ but slightly lighter colored. Dark grayish-brown (10YR 4/2), hard, firm, strong coarse- and medium-granular to fine subangular, blocky silty clay loam or fine-textured silt loam; very dark brown to very dark grayish brown (10YR 2.5/2), sticky, and slightly plastic when wet. Peds very stable in water; pH 4.8.

S50-Wn-21-3-4

A₃ 11-23"
(B₁)

Brown (10YR 5/3), hard, firm, moderate to strong medium- and fine-granular to fine-subangular, blocky silty clay loam; dark brown (7.5YR 3/2), sticky, and plastic when wet. Peds moderately stable in water; pH 4.6.

S50-Wn-21-3-5

B₁ or 23-39"

Brown (7.5YR 5/4 and 5/3), hard to very hard, fine-textured silty clay loam; large, firm, angular to subangular, blocky aggregates that break to strong, fine, subangular, blocky peds and medium granules. A few black (manganese) stains. Brown (7.5YR 4/4), sticky, and plastic when wet. Peds moderately stable in water. pH 4.7.

S50-Wn-21-3-6

B₂ 39-49"
cn
or
B₃ cn

Brown (7.5YR 5/3), hard to very hard, cloddy, plastic, sticky, fine-textured silty clay loam mottled with pale brown, light brown, strong brown, gray, and yellowish red; does not feel so heavy when very wet. Red and black specks, as well as many black splotches or stains, probably manganese; zone of maximum manganese accumulation. Peds moderately stable in water; pH 5.0.

S50-Wn-21-3-7

C₁ 49-73"

Mottled brown (7.5YR 5/4), yellowish-red, pale-brown, and gray, very hard to hard, nuciform, fine-textured silty clay loam; sticky and plastic. A few black manganese stains and moderate 1/2 to 2 mm. concretions; pH 5.1.

S50-Wn-21-3-8

C₂ 73-101"

Mottled yellowish-red (5YR 4/6), pinkish-gray (7.5YR 6/2), strong-brown (7.5YR 5/6), and little red and light brownish-gray, plastic, sticky silty clay loam; moderate or weak, subangular, blocky structure. A few 1-mm. reddish-brown and black concretions. pH 5.1.

Remarks: All layers are silty. Clay content increases with depth. Texture ranges from heavy silt loam on the surface to silty clay in the lower part of the profile. Roots are very numerous to a depth of 24 inches; gradually decrease to 39 inches, where there appears to be a root mat. Immediately below this is the manganese layer. This layer is very abrupt and distinct. In the vicinity where manganese is concentrated the soil is firm and brittle. The layers above 39 inches gradually grade into each other, especially the upper 3 mineral layers.

Winlock silty clay loam

Lewis Co., Washington

("Humic Prairie")

S50Wn-21-3-1 to 3-8

Lab. Nos. 501119 to 1126

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %						CS	VCS
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS		
1/2-0	A ₀	--	--	--	--	--	--	--	5.0	--	--	--	--	--	--	--	--	--
0-4	A ₁₁	8.4	1.2	0.3	0.1	22.3	32.3	31	5.2	4.39	36.4	36.1	55.3	3.3	2.5	0.9	1.2	0.4
4-11	A ₁₂	2.3	0.7	0.1	0.1	23.9	27.1	12	4.8	2.67	38.0	35.8	54.1	3.3	2.3	0.9	1.1	0.3
11-23	A ₃	1.1	0.9	0.1	0.1	17.9	20.1	11	4.7	1.04	40.0	35.3	52.8	2.9	2.2	0.8	1.1	0.2
23-39	B ₁	2.1	1.9	0.1	0.2	15.7	20.0	22	4.8	0.51	47.2	31.5	46.4	2.6	1.9	0.7	1.1	0.1
39-49	B _{2on}	5.1	2.9	0.1	0.2	13.5	21.8	38	5.0	0.20	54.8	25.6	37.7	2.5	2.1	1.0	1.5	0.4
49-73	C ₁	7.0	3.2	0.1	0.2	12.3	22.8	46	5.3	0.12	53.0	25.7	37.8	3.5	2.7	1.3	1.3	0.4
73-101	C ₂	6.0	3.0	0.1	0.3	12.6	22.0	43	5.2	0.05	60.4	22.6	33.2	2.4	1.7	0.9	1.0	0.4

Winlock silty clay loam

Collectors: Kilmer, Leighty, Roberts, Wheeting, June 6, 1950, 4:15 p.m. to 6:30 p.m.

Location: Lewis County, Washington, SE 1/4 SE 1/4 Sec. 5, T. 11 N., R. 1W.
Sample collected in northwest corner of school yard in an apparently virgin site approximately 1 1/2 miles north of Toledo.

Elevation: 300 feet.

Relief: Slightly undulating to nearly level old bench or terrace; overall slope approximately 2 percent.

Vegetation: Grass with some roses and a few ferns along fence rows. Some moss on the ground.

Drainage: Well to fairly well drained. Very little surface runoff. Moderate internal drainage to a semicemented manganese layer which appears to hold up the water and cause a perched water table. Rapid infiltration, moderately rapid permeability to the layer of greatest manganese accumulation.

Parent material: Mixed rocks, dominantly basic. Some very old formation, probably old glacial drift. Unable to determine whether it was glacial outwash or glacial till. Probably formed from Cascade glaciation. Rocks to a very low depth are soft and can be easily cut with a knife or spade; however, they still retain their original rounded and flat shape.

Biological activity: Many angle worms and evidence of worm activity to a depth of 40 inches. Evidence of fungal mycelia to a depth of 12 inches. Surface soil very much mixed, owing to worm activity.

Climate: At Centralia, Washington, which is approximately 100 feet lower in elevation and 20 miles north of sample site, the January average temperature is 38.5°F., July average is 64.0°F., and the growing season is 173 days. Mean annual precipitation for a 37-year period is 45.64 inches, divided as follows: January 6.59, February 5.02, March 4.81, April 2.85, May 2.37, June 1.92, July .60, August .97, September 2.16, October 3.65, November 7.19, and December 7.51. Average snowfall is 11 inches. Temperature at sample site when sample was collected was 54° in the shade, 50° at 3 inches below the surface of the soil, and 45° at 40 inches.

Profile: S50-Wn-21-4

A₀ 1/2-0" Root mat of grass roots--very dense mat; pH 5.7.

S50-Wn-21-4-1

A₁₁ 0-4" Dark grayish-brown (10YR 4/2), hard, strong to moderate, medium- and fine-granular silty clay loam or fine-textured silt loam with dense mat of grass roots; very dark-gray (2.5Y 3/1) to very dark brown (10YR 2/2) and moderately plastic when wet. Peds very stable in water. pH 5.8 at 2 inches, 5.5 at 4 inches. Roots are very fine. Some fungal mycelia. Gradual change to:

S50-Wn-21-4-2

A₁₂ 4-11" Rather similar to A₁₁ but coarser and more strongly granular. Dark grayish-brown (10YR 4/2), hard silty clay loam or fine-textured silt loam. Very water stable granules 1/4 to 1/2 inch, very large and irregular; readily break into smaller aggregates. Very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2), slightly sticky, and slightly plastic when wet. pH 5.5-5.4.

S50-Wn-21-4-3

A₃ 11-23" Faintly lighter colored, but has coarser granules than A₁₂. Dark grayish-brown (10YR 4/2), hard, strong, medium- and coarse-granular silty clay loam with some gravel; very dark grayish brown to very dark brown (10YR 2.5/2); sticky, and plastic when wet. Peds moderately stable to stable in water. pH 5.4.

S50-Wn-21-4-4

B₁ 23-36" Brown, hard to very hard, strong, fine subangular, blocky silty clay loam. Peds mostly 7.5YR 5/3 but are moderately 7.5YR 5/4 coated and are pale brown to very pale brown (10YR 6.5/3) when cut. Sticky and plastic. Very few black manganese stains and few 1-mm., semihard, strong-brown concretions. Peds moderately stable in water. pH 5.4-5.6. Nearly saturated when collected. Abrupt change to:

S50-Wn-21-4-5

B_{2cn} 36-54" Semicemented manganese-accumulation horizon. Brown (7.5YR 5/3), very hard, moderate, fine subangular, blocky fine-textured silty clay loam with a few grayish-brown splotches. Peds have some 7.5YR 5/4 coatings, but are very pale brown to pale brown or light brown when cut. Much black manganese staining and few reddish-brown, 1-mm. concretions. When wet, plastic, very sticky, and mostly brown (7.5YR 4/2) with 7.5YR 4/3 to 5YR 5/4 coatings; brown to strong brown when cut. Peds moderately stable in water. pH 5.4. This horizon is very irregular, even within a distance of 2 inches.

S50-Wn-21-4-6

B₃ 54-66" Brown, very hard, weak, medium subangular, blocky, fine-textured silty clay loam with some large and medium, light-brown, light brownish-gray, strong-brown, and yellowish-brown mottlings and few black manganese stains and splotches. Sticky and plastic. A few 1-mm., strong-brown and reddish-brown concretions. Peds moderately to slightly stable in water. pH 6.0.

S50-Wn-21-4-7

C 66-76" Mottled brown, light brownish-gray, yellowish-brown, and strong-brown, very hard, weak, medium subangular, blocky to massive, fine-textured silty clay loam. Moderate black manganese staining and splotching and a few 1-mm. concretions and coarse sand. When moist, firm and mottled brown, grayish brown, dark yellowish brown, and strong brown. pH 6.2.

Remarks: Soil was dry for 23 inches, then saturated down to 36 inches to the semi-cemented, firm layer very high in manganese. Some gravel in all layers. Many pinhead-size holes in layer from 23 to 36 inches. Possibly this is the reason there are no gray mottlings. Distinctly mottled below 36 inches. In oat field across the fence from where sample was taken soil appears to crush readily and form a thin distinctive layer, but it is not vesicular. It is dark grayish brown (10YR 4/2) when dry and very dark grayish brown (10YR 3/2) when moist. This soil was also saturated at a depth between 20 and 40 inches.

Winlock silty clay loam

Lewis Co., Washington

("Humic Prairie")

S50Wn-21-4-1 to 4-7

Lab. Nos. 501127 to 1133

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
0-4	A ₁₁	11.9	2.5	0.9	0.2	19.4	34.9	44	5.6	5.7	31.2	37.7	56.7	4.6	4.0	1.4	1.6	0.5
4-11	A ₁₂	6.0	1.4	0.4	0.1	20.2	28.1	28	5.2	3.23	34.6	37.1	56.0	3.8	3.2	1.2	1.0	0.2
11-23	A ₃	5.1	1.2	0.3	0.2	17.8	24.6	28	5.2	1.84	34.7	36.4	55.6	4.1	3.2	1.1	1.1	0.2
23-36	B ₁	8.6	2.9	0.2	0.2	12.6	24.5	48	5.2	0.56	42.2	31.6	47.6	4.4	3.6	1.1	1.0	0.1
36-54	B _{2cn}	9.3	3.2	0.2	0.2	12.2	25.1	51	5.4	0.39	55.6	24.3	36.7	2.8	2.5	1.0	1.0	0.4
54-66	B ₃	13.8	4.8	0.2	0.4	9.9	29.1	66	6.0	0.20	47.6	25.7	39.1	5.1	4.3	1.5	1.6	0.8
66-76	C	13.8	5.0	0.2	0.4	10.2	29.6	66	6.0	0.20	43.5	26.9	39.8	6.3	5.4	1.9	2.0	1.1

Melbourne silty clay loam

Collectors: Fowler, Kilmer, Leighty, Roberts, and Wheeting, June 7, 1950, 11:00 a.m. to 1:30 p.m.

Location: Lewis County, Washington, NW 1/4 SE 1/4 Sec. 10, T. 12 N., R. 3 W., or 6 miles northeast of Winlock, Washington. Sample collected under a Douglas-fir tree.

Elevation: Approximately 700 feet.

Relief: Sloping hillside with some cradle knolls and sags, 15 percent south slope. In places some outcrops of sandstone and shale.

Vegetation: Dominantly Douglas-fir, some cedar and alder, with dense understory of salal, Oregon grape, moss, ferns and other shrubs. Many fallen trees; difficult to traverse. Trees about 6 feet apart, tall and slim. Fir trees are 5 to 14 inches in diameter, approximately 60 to 80 feet tall, 25 to 35 years old. Most of the trees are second growth. Site quality 3.

Drainage: Well drained. Very little surface runoff, moderate internal drainage, moderately rapid permeability, rapid infiltration. There appears to be very little sheet or gully erosion.

Parent material: Soil derived from sandstone and shale, probably dominantly shale, quite deeply weathered.

Biological activity: Angle worms are numerous. Many spiders and other insects are present.

Climate: At Centralia, which is approximately 15 miles north and 500 feet lower in elevation, the January average temperature is 38.5, July average is 64.0° F., and the growing season is 173 days. Mean annual precipitation for a 37-year period is 45.64 inches, divided as follows: January 6.59, February 5.02, March 4.81, April 2.85, May 2.37, June 1.92, July .60, August .97, September 2.16, October 3.65, November 7.19, December 7.51. Average snowfall is 11 inches. Air temperature when sample was collected 56° F. in the shade, 52° F. at 3 inches below the surface, and 47° F. at 40 inches below the surface.

Profile: S50-Wn-21-5

S50-Wn-21-5-1

A ₀	1-0"	Nearly loose or very friable leaf mat of very dark brown, partly decomposed needles and moss; pH 5.6.
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S50-Wn-21-5-2

A ₁	0-4"	Light brownish-gray (10YR 6/2), grading toward pale-brown (10YR 6/3), fine-textured silt loam; hard, strongly medium- and coarse-granular to subangular, fine subangular, blocky with some very large granules; crushes readily to small aggregates when moist; dark grayish brown (10YR 3.5/2), sticky, and slightly plastic when wet. Outstanding characteristic of this horizon is the excellent structure of the very large aggregates which are stable in water. Some or few shot. Considerable fungal mycelia. pH 5.8.
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S50-Wn-21-5-3

A₃ 4-12" Pale brown (10YR 6/3) to brown (10YR 5/3), firm, very hard, distinctly granular or fine subangular, blocky silty clay loam; dark-brown (10YR 3.5/3), sticky, and moderately plastic when wet. pH 5.8 in upper part, 5.6 in lower part. This layer appears to be a complex in that it has some of the darker colored A₁ horizon mixed with it. Aggregates are stable in water. Roots are very numerous. Some or few shot and some 1-mm., very dark gray and reddish-brown concretions.

S50-Wn-21-5-4

B₂₁ 12-22" Somewhat variegated brown (7.5YR 5/3), hard to very hard silty clay loam; brown to dark brown (7.5YR 4/3), sticky, and moderately plastic when wet; distinctly medium and coarse granular to fine subangular, blocky structure; the aggregates are moderately stable in water; inside of peds very pale brown (10YR 7/4), but much brown (7.5YR 5/4) and little reddish-brown (5YR 4/4) coating; when moist, inside of peds brown (10YR 5/3) with brown (7.5YR 4/4) and reddish-brown (5YR 4/4) coating; some 1-mm., black and reddish-brown concretions; pH 5.0.

S50-Wn-21-5-5

B₂₂ 22-37" Similar to layer above except slightly more reddish coated aggregates and possibly slightly more clayey; possibly light silty clay; pH 5.0.

S50-Wn-21-5-6

B₃ 37-61" Slightly more clayey, but less coating on peds than B₂₂; very hard, strong, fine-subangular, blocky, fine-textured silty clay loam or coarse-textured silty clay that is sticky and moderately plastic; mostly very pale brown to pale brown or light brown inside peds, but moderately coated with yellowish brown, brown, strong brown, and reddish brown, with some polished sides; when moist, mostly brown (10YR 5/3) inside peds; dense peds; little black manganese coating; some 1-mm., black and reddish-brown concretions; pH 4.9. Very few roots in this horizon.

S50-Wn-21-5-7

BC -85" Cloddy silty clay or silty clay loam that is rather similarly colored as the above horizon except for less coating; mostly light yellowish brown to pale brown or very pale brown with some brown (7.5YR 5/3) coating; no distinct structure; clods are sharp, angular and break into small units with solid color when moist with exception of some black specks; sticky and plastic; pH 4.9.

85-97" Similar to above; not sampled.

S50-Wn-21-5-8

C₁ 97-113" Highly mottled light brownish-gray, pale-brown, light yellowish-brown, and brownish-yellow, very hard, mostly massive silty clay loam; when wet, sticky, plastic, and mottled grayish brown, brown, yellowish brown, and strong brown; possibly old weathered shale, but no unweathered rock fragments; pH 4.8.

Melbourne silty clay loam

Lewis Co., Washington

(Brown Podzolic or Lateritic?)

S50Wn-21-5-1 to 5-8

Lab. Nos. 501134 to 1141

Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %						
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	VCS
1-0	A ₀	--	--	--	--	--	--	--	4.6	--	--	--	--	--	--	--	--	--
0-4	A ₁	7.1	1.4	0.8	0.8	14.0	24.1	42	5.5	2.75	22.6	43.1	63.3	8.8	3.0	1.0	1.0	0.3
4-12	A ₃	4.7	1.4	0.6	0.4	12.5	19.6	36	5.3	1.26	27.2	41.0	59.9	8.0	2.6	1.0	1.0	0.3
12-22	B ₂₁	4.3	1.9	0.6	0.2	13.8	20.8	34	5.0	0.22	39.7	34.4	49.7	6.5	2.2	0.9	0.8	0.2
22-37	B ₂₂	2.4	2.0	0.4	0.3	16.6	21.7	24	4.9	0.21	42.2	33.1	47.1	6.8	2.3	0.8	0.6	0.2
37-61	B ₃	1.9	2.2	0.4	0.4	17.0	21.9	22	4.8	0.16	40.4	32.2	45.7	9.0	3.0	0.9	0.8	0.2
61-85	BC	3.0	3.9	0.5	0.3	22.6	30.3	25	4.6	0.14	48.6	28.5	39.6	7.4	2.9	0.8	0.6	0.1
97-113	C ₁	6.7	6.2	0.5	0.3	25.1	38.8	35	4.6	0.13	48.4	23.9	33.5	9.8	6.8	1.1	0.4	0.0

Melbourne silty clay loam

Collectors: Fowler, Kilmer, Leighty, Roberts, and Wheeting, June 7, 1950, 4:30 p.m. to 7:30 p.m. and from 8:30 a.m. to 11:00 a.m. on June 8.

Location: Lewis County, Washington, SE 1/4 SE 1/4 Sec. 6, T. 14 N., R. 4 W., or about 13 miles west of Centralia. Sample collected on ridge top under old Douglas-fir.

Elevation: 400 feet.

Relief: Narrow ridge top on a 7 percent northwest slope with steep 20 to 25 percent slopes on both sides. Soils in the vicinity are rolling.

Vegetation: Cut-over land, dominantly Douglas-fir second growth, with some dogwood, alder, and big leaf maple. Understory of vetch, Oregon grape, ferns, moss, salal, thimbleberry, and Indian arrowwood or ocean spray. One fir 20 inches in diameter, 66 years old. Fairly uniform growth. Many old tree stumps. Land very difficult to traverse.

Drainage: Well drained. Very little surface runoff, moderate internal drainage, rapid infiltration, moderately rapid permeability. Little or no sheet erosion.

Parent material: Soil derived from sandstone and shale residuum, probably dominantly shale, quite deeply weathered. In road cuts hard rock is visible, but it is very difficult to find hard parent rock in excavations. The parent material appears to weather fairly deeply, and it is difficult to distinguish parent material from soil material.

Biologic activity: Some worm activity, but not so pronounced as in the other sample of Melbourne. Very high in mycelia in the A and upper B horizon; decreases with depth.

Climate: At Oakville, which is approximately 10 miles northwest and 300 feet lower in elevation, the January average temperature is 38.6°F., July average is 62.7°F., and the growing season is 163 days. Mean annual precipitation for a 22-year period 51.35 inches, divided as follows: January 7.97, February 5.76, March 5.86, April 3.50, May 1.98, June 1.31, July .40, August 1.28, September 2.37, October 4.69, November 6.43, and December 9.80. Average snowfall is 9.3 inches. The precipitation at the sample site is approximately the same as that at Oakville. Temperature in the shade when sample was collected at 8:30 a.m. June 8, 1950, 55°F., 51°F. at 3 inches below the surface; and 50°F. at 40 inches below the surface.

Profile: S50-Wn-21-6

S50-Wn-21-6-1

A ₀	1-0"	Nearly loose or very friable leaf mat consisting of very dark brown, moderately decomposed deciduous leaves, fir needles, wood, and a great deal of moss; very high in fungal mycelia; pH 5.4 to 6.0. Gradual change to layer below:
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S50-Wn-21-6-2

A ₁	0-4"	Very dark grayish-brown (10YR 3/2) to dark-brown (7.5YR 3/2), strong, medium- and coarse-granular, slightly plastic, heavy silt loam or light silty clay loam; some or few shot; very dark brown (10YR 2/2) and friable when moist; pH 5.5. Roots very numerous in this horizon as well as in horizons above and below. Peds are very stable in water.
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S50-Wn-21-6-3

A₃ 4-10" Dark-brown to brown (7.5YR 4/2), very hard, strong, medium- and coarse-granular, heavy silt loam or silty clay loam; many firm or very firm, 1/4 inch granules or subangular, blocky peds; dark brown (7.5YR 3/2), slightly sticky, and moderately plastic when wet; some or few shot; lighter color when cut; pH 5.5. Not so much A₁ material in this horizon as in the other sample of Melbourne silty clay loam, but definitely more fungal mycelia than in the same horizon of the other profile. Peds are stable to very stable in water. Some 1-mm., black and reddish-brown manganese and iron specks and concretions in this and the above horizons.

S50-Wn-21-6-4

B₁ 10-20" Brown (7.5YR 5/4) to reddish-brown (5YR 4/4), very hard, very firm to firm, strong, fine subangular, blocky silty clay or silty clay loam; less red than layer below; when wet, sticky, plastic, and dark brown (7.5YR 4/3) to dark reddish brown (5YR 4/4); peds moderately stable in water; very few very fine concretions; no shot; pH 4.8.

S50-Wn-21-6-5

B₂ 20-29" Brown (7.5YR 5/4), very hard, moderately fine- and medium-subangular, blocky silty clay or silty clay loam; peds heavily coated reddish brown (5YR 4/4), but light brown (7.5YR 6/3) when cut; when wet, sticky, plastic, and brown (7.5YR 4/4), but coated reddish brown (5YR 4/4) and brown (7.5YR 5/3); firm peds; peds moderately stable in water; very few 1-mm., black and reddish concretions; pH 4.7.

S50-Wn-21-6-6

B₃ 29-50" Brown (7.5YR 5/4), very hard silty clay or silty clay loam with very distinctly polished, moderate medium- subangular, blocky peds coated reddish brown (5YR 4/4); some unweathered, light yellowish-brown sand grains and some gray mottling; brown (7.5YR 4/3), coated reddish brown (5YR 4/4), and firm when moist; sticky and moderately plastic, slightly stable peds in water; pH 4.7. Roots much less numerous than layer below.

S50-Wn-21-6-7

C₁ 50-71" Brown (7.5YR 5/3), very or extremely hard, mostly massive silty clay or silty clay loam with distinct coating, but very few fine, distinct, light brownish-gray veins and mottlings; brown (7.5YR 4/4), sticky, and plastic when wet; some unweathered, light yellowish-brown sand grains; pH 4.7. Partially weathered parent material.

S50-Wn-21-6-8*

C₂ 71-99" Brown (7.5YR 5/4), very or extremely hard, mostly massive silty clay loam with few fine, light-gray and light yellowish-brown mottlings; sticky and plastic; pH 4.6. Slightly weathered parent material.

Remarks: The B₃ horizon may possibly be decomposed fine-textured sandstone, and the highly polished material may be along the natural rock fractures. This profile does not have the appearance of having a zone of manganese accumulation.

Melbourne silty clay loam

Lewis Co., Washington

(Brown Podzolic or Lateritic?)

S50In-21-6-1 to 6-8

Lab. Nos. 501142 to 1149

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %								
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS	
1-0	A ₀	--	--	--	--	--	--	--	5.1	--	--	--	--	--	--	--	--	--	--
0-4	A ₁	20.7	6.3	1.5	0.5	24.8	53.8	54	5.3	5.2	36.3	36.7	51.5	5.1	3.5	1.4	1.6	0.6	0.6
4-10	A ₃	17.2	6.0	1.1	0.5	25.3	50.1	50	5.0	3.02	39.9	35.1	50.0	5.0	3.1	1.1	0.8	0.1	0.1
10-20	B ₁	15.1	7.7	0.5	0.5	29.3	53.1	45	4.6	1.11	56.9	25.1	34.3	5.3	2.6	0.6	0.3	0.0	0.0
20-29	B ₂	10.1	6.7	0.5	0.4	33.6	51.3	34	4.5	0.57	52.0	25.1	35.4	6.9	4.5	0.9	0.3	0.0	0.0
29-50	B ₃	6.6	6.2	0.4	0.4	34.0	47.6	28	4.4	0.18	45.3	27.8	37.9	7.3	6.5	1.9	1.0	0.1	0.1
50-71	C ₁	5.0	7.4	0.4	0.4	31.0	44.2	30	4.5	0.22	45.4	31.4	42.2	6.6	4.1	1.1	0.6	0.0	0.0
71-99	C ₂	4.4	7.3	0.4	0.4	28.3	40.8	31	4.6	0.16	49.5	31.2	42.5	4.3	2.1	0.8	0.6	0.2	0.2

Oro shotty loam--"Gray Podzolic"

Collectors: Fowler, Kilmer, Leighty, Roberts, and Wheeting, June 8, 1950, 2:30 p.m. to 5:00 p.m.

Location: Mason County, Washington, NW 1/4 NW 1/4 Sec. 24, T. 21 N., R. 2 W., or approximately 13 miles northeast of Shelton. Sample collected under a Douglas-fir and a cedar.

Elevation: 250 feet.

Relief: Gently undulating, glaciated uplands with many cradle knolls. About 3 percent slope.

Vegetation: Mixture of Douglas-fir and cedar, with smaller alder and hemlock. Understory of Oregon grape, ferns, moss, some huckleberries, and little Oregon maple and salal. Huckleberry and hemlock growing in old tree stumps. Fir 26 inches in diameter, 50 years old. Cedar 22 inches in diameter, 66 years old.

Drainage: Moderate drainage. Moderate internal drainage, moderate infiltration, moderately slow permeability. There appears to be little or no erosion and little or no surface runoff.

Parent material: Vashon glacial till of mixed origin.

Biological activity: Some mycelia in leaf mat only. Some centipedes. No ants or worms observed.

Climate: At Grapeview, which is slightly lower in elevation and about 5 miles north, the January average temperature is 38.8° F., July average temperature is 64.8° F., and the growing season is 209 days. Mean annual precipitation for a 31-year period is 52.5 inches, divided as follows: January 8.87, February 6.23, March 5.05, April 3.07, May 2.22, June 1.44, July .64, August .87, September 2.21, October 4.51, November 8.21, and December 9.18. Average snowfall is 8.3 inches. The air temperature at 5:00 p.m. at sample site was 58° F., 52° F., at 3 inches below the surface, and 50° at 20 inches below the surface.

Profile: S50-Wn-23-1

S50-Wn-23-1-1

A ₀	1/4-0"	Very dark brown (10YR 2/2), decomposed needles and moss, dominantly H material; pH 6.0. Abrupt change to:
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S50-Wn-23-1-2

A _{1cn} or	0-1/2"	Grayish-brown (2.5Y 5/2), weak, granular, but distinctly shotty loam; very dark grayish brown (10YR 3/2) when moist; pH 6.6.
A _{2cn}		Grades into:

S50-Wn-23-1-3

A _{3cn} or	1/2-5"	Grayish-brown to dark grayish-brown (10YR 4.5/2), slightly plastic very shotty loam; high in organic matter; dark grayish brown (10YR 3/2) when moist; pH 6.4 at 1 inch, 6.2 at 3 inches.
AB _{cn}		

S50-Wn-23-1-4

B _{21cn}	5-10"	Brown (10YR 5/3) very shotty loam; horizon of greatest shot accumulation; shot 1/4 to 1/2 inch in diameter and irregularly rounded, some of them concentric; firm aggregates; slightly sticky; dark grayish brown (10YR 3/2) when moist; pH 6.0 at 6 inches, 5.8 at 8 inches, 5.2 at 10 inches.
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S50-Wn-23-1-5

B₂₂ 10-17" Pale-brown to brown (10YR 5.5/3), sticky, slightly plastic shotty loam containing some gravel and some shot, the shot decreasing with depth; dark brown to dark grayish brown (10YR 4/2.5) when moist; pH 5.2.

S50-Wn-23-1-6

B₃ 17-22" Pale-brown to light yellowish-brown (10YR 6/3.5) shotty or gravelly loam; firm angular aggregates; some splotches or iron, dark brown to brown (10YR 4/3) when moist; pH 5.2. The lower part of this horizon contains a root mat. Abrupt change to:

S50-Wn-23-1-7

M 22-22 1/4" Iron cemented layer. This horizon dominantly brown (7.5YR 5/4) to reddish brown, but in places there is a 1/16 inch white (2.5Y 8/2) or light-gray layer over bright brown or reddish-brown material, probably very high in iron; pH of white material 4.8, of brown material 5.4. White or light-gray layer appears to be a siliceous layer similar to an A₂ horizon, but is very thin. The iron layer appears to be very similar to the ortstein of a Podzol. Some gravel, some of which are quartzites.

S50-Wn-23-1-8

MC 22 1/4-24" Light Brownish-gray (2.5Y 6/2) gravelly sandy loam indurated till with very few fine, distinct, yellowish-brown (10YR 5/4) mottlings and scattered reddish-brown stains; very hard, rings when hit with a hammer; high in gravel content; some of the pebbles have a light-gray siliceous coating; when moist, olive brown (2.5Y 4/3); pH 5.2.

S50-Wn-23-1-9

C 24-40" Light brownish-gray (2.5Y 6/2), cemented till of Vashon glaciation containing scattered fine yellowish-brown mottlings; gravelly sandy loam with considerable clay; olive brown (2.5Y 4/2) when moist; no roots; very gravelly; gravel consists of mixed material including andesite, basalt, granite, and metamorphic rocks; pH 5.2.

Remarks: The B horizons have about the same structure throughout. B₁ (?) or A₃ very difficult to collect. In places looked like some ortstein or orterde.

Mason Co., Washington

Oro shotty loam

Lab. Nos. 501150 to 1158

S50Wn-23-1-1 to 1-9

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1/4-0	A ₀	--	--	--	--	--	--	--	6.0	--	--	--	--	--	--	--	--	--
0-1/2	A _{10n}	21.3	0.7	0.6	0.4	19.0	42.0	55	6.0	4.94	16.8	27.2	39.5	11.0	14.4	7.4	6.8	4.1
1/2-5	A _{30n}	6.7	0.9	0.5	0.2	21.3	29.6	28	5.5	2.92	17.4	27.8	40.2	9.7	12.5	6.5	7.2	6.5
5-10	B _{210n}	1.3	0.5	0.4	0.1	20.3	22.6	10	5.0	1.30	17.2	25.9	37.3	9.4	12.4	6.7	8.6	8.4
10-17	B _{220n}	1.5	0.7	0.4	0.1	17.6	20.3	13	5.2	1.10	17.0	25.6	37.4	9.9	13.4	7.1	8.6	6.6
17-22	B ₃	2.2	2.1	0.4	0.2	13.2	18.1	27	5.0	0.74	14.2	21.7	33.2	11.9	17.2	8.7	9.0	5.8
22-22 1/4	M	2.2	2.0	0.2	0.1	7.8	12.3	36	5.2	0.23	10.2	17.8	35.0	9.4	21.7	9.4	8.7	5.6
22 1/4-24	MC	2.2	2.0	0.3	0.1	6.8	11.4	40	5.2	0.13	8.1	15.8	27.9	13.5	18.6	9.0	12.1	10.8
24-40	C	2.6	1.6	0.2	0.2	4.5	9.1	50	5.2	0.09	7.7	15.5	28.5	14.4	21.6	10.0	10.6	7.2

Oro shotty loam--"Gray Podzolic"

Collectors: Fowler, Kilmer, Leighty, Roberts, Wheeting, June 9, 1950, 11:00 a.m. to 3:00 p.m.

Location: Mason County, Washington, SE 1/4 NW 1/4 sec. 20, T. 22 N., R. 1 W., or 1/2 mile west of Allyn. Sample collected under Douglas-fir.

Elevation: 200 feet.

Relief: Sloping, glacial uplands, 12 percent east slope.

Vegetation: Douglas-fir, hemlock, cedar, and understory of huckleberries, salal, ferns, moss, dogwood, and few alder. One fir 20 inches in diameter, 65 years old, and 130 feet high. Site quality 2. Trees are dense. Lots of fallen logs with many young hemlock trees growing from the decayed wood. This is cut-over land, cut approximately 60 years ago.

Drainage: Profile appears to be well drained, but it is possible that there is somewhat slow permeability of air and water through the profile. Moderate to good internal drainage. Good infiltration, good permeability. Appears to be little or no runoff and little or no erosion.

Parent material: Vashon glacial till of mixed origin.

Biological activity: Fungal mycelia, but very little insect activity.

Climate: At Grapeview, which is 4 miles south of sample site, the January average temperature is 38.8° F., July average temperature is 64.8° F., and the growing season is 209 days. Mean annual precipitation for a 31-year period is 52.5 inches, divided as follows: January 8.87, February 6.23, March 5.05, April 3.07, May 2.22, June 1.44, July .64, August .87, September 2.21, October 4.51, November 8.21, and December 9.18. Average snowfall is 8.2 inches. The air temperature at sample site at 2:00 p.m. 60° F. in the shade, 55° at 3 inches, 50° at 40 inches.

Profile: S50-Wn-23-2

S50-Wn-23-2-1

A ₀	1-0"	Nearly loose or very friable leaf mat of very dark brown, partly decomposed moss and needles; some gravel, which is stained with organic matter, and which is also less weathered than pebbles at a lower depth; small amount of shot; pH 5.6-5.8.
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S50-Wn-23-2-2

A _{1cn}	0-3"	Dark grayish-brown to grayish-brown (10YR 4.5/2), very friable shotty loam; very dark brown to very dark grayish brown (10YR 2.5/2) when moist; pH 5.6 at 1 inch, 5.8 at 3 inches.
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S50-Wn-23-2-3

B _{1cn}	3-10"	Brown (10YR 5/3), firm to brittle very shotty loam; very high in irregularly rounded, very hard shot, which range from 1/4 to 1/2 inch in diameter; dark brown (10YR 3/3), nonsticky, and nonplastic when wet; pH 5.9 at 5 inches.
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S50-Wn-23-2-4

B _{21cn}	10-17"	Pale-brown (10YR 6/3) shotty gravelly loam; much more gravel than layer above, but much less shot; soil has some small round holes; friable and porous, but feels dead; dark brown (10YR 4/3) and slightly plastic when wet; pH 5.4.
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S50-Wn-23-2-5

B_{22cn} 17-25" Similar to B_{21cn}, but faintly more clayey; pale brown (10YR 6/3) shotty gravelly loam; brown to dark brown (10YR 4/3), slightly sticky, and slightly plastic when wet; pH 5.2.

S50-Wn-23-2-6

B₃₁ 25-33" Pale-brown (10YR 6/3), friable gravelly loam that is distinctly light gray and light yellowish-brown mottled; pH 5.4. Changes abruptly to:

S50-Wn-23-2-7

B₃₂ 33-43" Mottled light-gray (2.5YR 7/1), pale-yellow (2.5Y 7/3), light yellowish-brown (10YR 6/4), and yellowish-brown (10YR 5/4) gravelly loam; firm angular aggregates; pH 5.4. Abrupt change to:

S50-Wn-23-2-8

M 43-45" Upper 1/4" A₂:
Light-gray loam; few brown or reddish-brown concretions; pH 5.0.
Next 1/8" B_{21r}:
Brown or reddish-brown, weakly cemented loam; many reddish-brown concretions; pH 5.4.
Next 1 5/8":
Light brownish-gray (2.5Y 6/2) to light olive-gray (5Y 6/2), very hard, weak platy to massive, weakly cemented, coarse-textured loam with many prominent, large, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/4) mottlings; very slightly gravelly; pH 5.4.

S50-Wn-23-2-9

C 45-60" Similar to layer above, but more friable, less hard, and less mottled; light brownish-gray (2.5Y 6/2) to light olive-gray (5Y 6/2), hard, massive, very weakly cemented, coarse textured loam with some prominent white (5Y 8/2), light yellowish-brown (2.5Y 6/4), and yellowish-brown (10YR 5/4) mottlings; very few or no roots; gravel dominantly andesitic; till; pH 5.2.

Remarks: Most of the horizons grade into each other, but appear distinct at 33 inches and very distinct at 43 inches at the top of the pan. Some gravel in all layers; mostly andesitic, but some are granitic. Oro examined in some other places has a distinct A₂ horizon with a firm, shot-cemented layer at 10 inches which appeared to stop the roots. The ironpan ranges from 23 to 43 inches below the surface. Soil occurs on footslopes near the bay. In places the soil material is definitely mottled, showing restricted drainage possibly caused from seeps. In other places the soil appears to be well drained. Many areas have cedar vegetation, indicating that the profile is somewhat moist. In this site the till is not so typical as in some of the other areas, since it is a little bit heavier textured and less gravelly and does not contain so many rocks as other sites. Some fungal mycelia are present to a depth of 10 inches.

Oro shotty loam

Mason County., Washington

(Gray Wooded?)

S50Wn-23-2-1 to 2-9

Lab. Nos. 501159 to 1167

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1-0	A ₀	--	--	--	--	--	--	--	5.2	--	--	--	--	--	--	--	--	--
0-3	A _{1en}	8.4	1.0	0.6	0.1	16.8	26.9	38	5.5	2.86	12.1	18.6	29.8	10.0	19.7	11.0	10.2	7.2
3-10	B _{1-en}	2.9	0.7	0.5	0.1	14.2	18.4	23	5.2	1.49	15.7	18.1	29.2	9.6	19.4	10.8	9.6	5.7
10-17	B _{21-en}	1.0	0.5	0.4	0.1	12.2	14.2	14	5.3	0.82	14.5	18.7	30.3	9.8	19.4	10.7	9.4	5.9
17-25	B _{22-en}	1.1	0.5	0.3	0.1	12.2	14.2	14	5.3	0.71	14.0	18.6	29.6	9.9	19.8	11.0	9.3	6.4
25-33	B ₃₁	1.8	0.9	0.2	0.2	9.8	12.9	24	5.2	0.51	13.5	19.3	31.1	11.1	19.6	10.1	9.0	5.6
33-43	B ₃₂	3.0	1.6	0.2	0.2	9.0	14.0	36	5.2	0.38	12.6	22.7	37.6	12.5	17.9	9.2	7.4	2.8
43-45	M	2.4	1.3	0.1	0.4	7.6	11.8	36	4.9	0.12	9.2	18.9	34.0	13.1	16.8	9.2	11.2	6.5
45-60	C	4.4	2.4	0.1	0.5	9.0	16.4	45	4.9	0.12	12.9	21.2	39.5	13.8	16.5	7.3	6.7	3.3

Shelton gravelly sandy loam

Collectors: Fowler, Kilmer, Leighty, Roberts, and Wheeting, June 9, 1950, 4:30 p.m. to 6:30 p.m.

Location: Mason County, Washington, SW 1/4 SE 1/4 Sec. 23, T. 20 N., R. 4 W. or 2.7 miles west of Shelton. Sample collected in open area that has been fairly recently cut over.

Elevation: 400 feet

Relief: Gently undulating or gently sloping (8 percent slopes), glacial uplands with many cradle knolls.

Vegetation: Dominantly Douglas-fir with understory of ferns, salal, moss, blueberry, Oregon grape, and few dogwood. Trees 6 to 8 feet apart and 4 to 14 inches in diameter. Several fir trees 15 inches in diameter are 43 to 49 years old and 93 to 99 feet high. This area would be in site class 3.

Drainage: Very well drained. Moderate to rapid internal drainage; rapid infiltration, rapid permeability. Very little surface runoff. Little or no sheet erosion.

Parent material: Vashon till of mixed origin, but dominantly basaltic and andesitic. Very few rocks are light-colored granitic.

Biological activity: Very little biological activity observed.

Climate: At Union City, Washington, which is approximately 10 miles north of sample site, the climate for the years 1893 to 1907 was as follows: January average temperature 39.2°F., July average 64.2°F., frost-free period 175 days. Mean annual precipitation 83.13 inches, divided as follows: January 12.56, February 10.75, March 8.24, April 4.99, May 3.28, June 2.64, July .64, August .54, September 3.61, October 6.74, November 14.74, and December 14.40. Average annual snowfall was 26.8 inches. Temperature at sample site at 4:30 p.m. 72°F. in the air, 60°F at 3 inches, and 52°F. at 27 inches below the surface.

Profile: S50-Wn-23-3

S50-Wn-23-3-1

A ₀	1-0"	Loose or very friable leaf mat of very dark brown, partly decomposed needles, moss, and some grass roots; pH 4.8.
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S50-Wn-23-3-2

A ₁	0-3"	Dark grayish-brown (10YR 4/2) to dark-brown (7.5YR 4/2) gravelly or very gravelly sandy loam; granular, water-stable aggregates, breaking to very fine granules (crumbs) or single grains; very dark brown (7.5YR 2/2), nonsticky, and slightly plastic to nonplastic when wet; pH 5.2. Some mycelia. Many rounded particles 1 to 5 mm. in diameter, but most appear to be very coarse sand and very fine pebbles that are rather highly weathered with probably only very few shot.
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S50-Wn-23-3-3

AB or A ₃ or (B ₂₁)	3-9"	Brown (7.5YR 5/3.5), very fine granular (crumb) to single-grain very gravelly sandy loam; dark reddish-brown (5YR 3/3), nonplastic, and nonsticky when wet; many rounded particles 1 to 5 mm. and larger in diameter, but apparently most are very coarse sand and very fine pebbles that are highly weathered and coated with soil material and iron; only very few shot larger than 1 mm.; pH 5.2.
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S50-Wn-23-3-4

B₂ 9-18" Stronger in chroma and very slightly more clayey than above horizon. Brown to strong-brown (7.5YR 5/5), very fine granular (crumb) to single-grain very gravelly sandy loam; small rounded particles as in above horizon; dark reddish-brown (5YR 3/4), nonplastic, and very slightly sticky when wet; pH 5.2.

S50-Wn-23-3-5

B₃ 18-27" Yellowish-brown (10YR 5/4), very fine granular (crumb) to single-grain gravelly sandy loam (or gravelly loam); dark brown (7.5YR 4/4) and very slightly plastic when wet; coating on pebbles as above; pH 5.2.

S50-Wn-23-3-6

C_{m1} 27-36" Light yellowish-brown (10YR 6/4), gravelly sandy loam, semi-cemented hardpan; has some root mat above it, but some roots or B_{3m} penetrate it; it is possibly disintegrated. It is firm to hard; need crowbar when digging out this layer. Dark brown (7.5YR 4/3) when moist; much light yellowish-brown coating on pebbles. pH 5.2.

S50-Wn-23-3-7

C_{m2} 36-40" Definite hardpan, high in iron in upper few mm. Root mat on top; no roots penetrate this layer. Mostly light yellowish-brown (10YR 6/4), strongly or weakly cemented gravelly sandy loam with some or few reddish-brown stains in cracks and around pebbles; much light yellowish-brown coating on pebbles. pH 5.2.

40-46" Not sampled.

S50-Wn-23-3-8*

C 46-54" Light yellowish-brown (10YR 6/4), firm, very weakly cemented gravelly sandy loam or loam; pebbles are somewhat clay and iron coated. pH 5.4. No gray layers even in the till.

Remarks: In the 0 to 9 inch layer, of 9 pounds of soil, 6 1/4 pounds of material were larger than 2 mm., 3 1/2 pounds were larger than 1/4 inch, 2 pounds were larger than 1/2 inch. Many rounded, shotlike particles are less than 2 mm. Texture with pebbles excluded is a fine sandy loam. The pebbles in the 0 to 9 inch layer are both angular and rounded, and are soil and iron covered.

In the 9 to 18 inch layer, out of 7 pounds, 4 3/4 pounds are larger than 2 mm., 2 3/4 pounds are larger than 1/4 inch, 1 1/2 pounds are larger than 1/2 inch. Soil has some hard rounded shot less than 2 mm. in diameter.

S50Wn-23-3-1 to 3-8 Lab. Nos. 501168 to 1175

Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	VCS	
1-0	A ₀	--	--	--	--	--	--	--	4.8	--	--	--	--	--	--	--	--	--	
0-3	A ₁	8.3	1.0	0.6	0.2	22.5	32.6	31	5.4	5.0	12.8	27.3	40.9	9.0	13.6	7.4	8.6	7.7	
3-9	A ₃	2.4	0.9	0.3	0.1	17.3	21.0	18	5.3	2.52	13.7	26.7	39.7	9.2	13.1	7.5	8.8	8.0	
9-18	B ₂	1.1	0.9	0.2	0.1	14.6	16.9	14	5.3	0.94	13.2	22.7	34.1	8.8	13.8	8.6	9.9	11.6	
18-27	B ₃	2.4	1.0	0.2	0.2	13.5	17.3	22	5.4	0.57	11.5	20.6	31.5	9.3	14.6	9.4	11.9	11.8	
27-36	C _{m1}	2.6	0.8	0.1	0.2	12.3	16.0	23	5.3	0.34	8.0	16.3	25.9	8.6	14.3	10.1	16.5	16.6	
36-40	C _{m2}	4.4	2.1	0.1	0.3	11.6	18.5	37	5.2	0.28	7.2	14.6	24.1	9.1	14.2	10.0	16.5	18.9	
46-54	C	4.9	1.6	0.1	0.3	7.9	14.8	47	5.6	0.11	4.9	20.1	32.2	10.2	16.2	10.6	14.3	11.6	

Shelton gravelly sandy loam

Collectors: Fowler, Kilmer, Leighty, Roberts, and Wheeting, June 10, 1950, 8:30 a.m. to 11:30 a.m.

Location: Mason County, Washington, NW 1/4 NE 1/4, Sec. 10, T. 20 N., R. 5 W., or approximately 11 miles west of Shelton. Sample collected under Douglas-fir and lodgepole pine.

Elevation: 430 feet.

Relief: Gently undulating, glacial upland, approximately 3 percent ^s southeast slope.

Vegetation: Cut-over land that has been burned in the past. This area does not appear to be nearly so severely burned as other areas in the vicinity. Dominant vegetation is Douglas-fir and lodgepole pine, with an understory of salal and ferns. Not very much moss on the trees. Some dead trees 9 to 11 inches in diameter. A lodgepole pine 12 inches in diameter is 25 years old. Douglas-fir trees that are approximately 8 inches in diameter are about 20 years old. Many of the trees are only 2 feet apart and 1 to 8 inches in diameter.

Drainage: Very well drained. Moderate to rapid internal drainage, rapid infiltration, rapid permeability. Very little surface runoff. Little or no sheet erosion.

Parent material: Vashon till of mixed origin, but dominantly basaltic and andesitic. Very few rocks are light-colored granitic.

Biological activity: Some slugs, grubs, and other insects. No worms, but some fungal mycelia. Not much noticeable biological activity.

Climate: At Cushman Dam, which is approximately 18 miles north and 360 feet higher in elevation, the January average temperature is 36.6°F., the July average is 63.4°F., and the growing season is 209 days. The average annual precipitation for a 17-year period is 97.66 inches, divided as follows: January 16.20, February 12.47, March 9.39, April 6.47, May 4.22, June 2.56, July 1.05, August .87, September 4.51, October 9.34, November 13.55, and December 17.02. Average annual snowfall is 26.7 inches. The precipitation and snowfall at the sample site are somewhat less than at Cushman Dam. Air temperature 9:00 a.m. was 58°F. in the shade, 52°F. at 3 inches below the surface of the soil, and 47°F. at 30 inches below the surface of the soil.

Profile: S50-Wn-23-4-

S50-Wn-23-4-1

A ₀	1-0"	Loose or very friable leaf mat of very dark brown, partly decomposed fir and lodgepole pine needles. pH 5.0. Many holes. Some mycelia and some grubs. Very definite very thin leaf litter or L on top. Abrupt change to:
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S50-Wn-23-4-2

A ₁	0-2"	Dark grayish-brown (10YR 4/2), weak, fine or very fine granular or fine-crumb very gravelly sandy loam; very dark brown (10YR 2/2), nonsticky, and nonplastic when wet. pH 4.9. No evidence of an A ₂ horizon. Grades to:
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S50-Wn-23-4-3

AB or A ₃	2-9"	Brown (7.5YR 4/3), very fine crumb (or granular) to single-grain very gravelly sandy loam or fine sandy loam; dark brown (7.5YR 3/2) and very slightly plastic when wet. pH 4.8. Very irregular, but changes rather abruptly to:
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S50-Wn-23-4-4

B₂ 9-17" Brown (7.5YR 5/4), very fine crumb (or granular) to single-grain very gravelly sandy loam; dark reddish-brown (5YR 3/3) to dark brown (7.5YR 3.5/4) and very slightly plastic when wet. pH 5.0. This is the reddest layer in the profile. Grades into:

S50-Wn-23-4-5

B₃ 17-30" Yellowish-brown to brown (9YR 5/4), very fine crumb (or granular) to single-grain very gravelly sandy loam or coarse sandy loam; dark brown (7.5YR 4/3) and very slightly plastic when wet. pH 5.2. Abrupt change to:

S50-Wn-23-4-6

C_m 30-32" Indurated, iron-stained, gravelly sandy loam till, mostly gray (2.5Y 6/1) to light olive gray (5Y 6/2) with few distinct large splotches of reddish-brown and light yellowish-brown. In places there are lenses of light-gray (10YR 7/1) siliceous; material that rest on lenses of yellowish-red (5YR 4/8) sandy material that appear to be very similar to an A₂ horizon over an ortstein. Root mat above indurated pan.² pH in root mat 4.8-5.0; in reddish and gray pan 5.8. Grades into:

S50-Wn-23-4-7

C 32-42" Gray to light-gray (2.5Y 6/1) or light olive-gray (5Y 6/2), gravelly sandy loam, strongly cemented till with very few stains of light brown and very pale brown. pH 5.8. Necessary to use a crowbar; very hard to dig. Some fine roots. A broken surface of the till shows very thin iron-stained sheets.

Remarks: The indurated till normally occurs at a depth of about 30 inches, but may range from 24 to 40 inches. In 8 pounds of the 0 to 9 inch layer, 5 1/2 pounds, or 69 percent of the material, consist of pebbles larger than 2mm.; 4 pounds are larger than 1/4 inch; and 2 pounds are larger than 1/2 inch. In 12 pounds of the B horizon, 9 pounds, or 75 percent, are larger than 2mm.; 6 pounds, or 50 percent, are larger than 1/4 inch; and 4 pounds, or 33 1/3 percent, are larger than 1/2 inch. The pebbles are all distinctly iron coated. Most of the gravel and rocks are andesitic and basaltic, but a number of granitic or light-colored crystalline rocks are scattered on the surface. The pebbles do not appear to be quite so hard as the rocks in some of the drier areas.

S50Wn-23-4-1 to 4-7

Lab. Nos. 501176 to 1182

Depth Inches	Horizon	M.E./100 Grams Soil						pH	% O.C.	Size Classes %						CS	VCS
		Ca	Mg	K	Na	H	S+			Clay	III	USDA Silt	VFS	FS	MS		
1-0	A ₀	--	--	--	--	--	--	4.8	--	--	--	--	--	--	--	--	--
0-2	A ₁	9.2	1.5	0.8	0.3	37.5	49.3	5.1	7.1	12.2	27.4	43.8	10.2	11.1	4.7	7.9	10.1
2-9	A ₃	3.4	0.6	0.4	0.2	27.4	32.0	5.3	5.4	12.4	27.1	43.2	9.9	10.6	4.5	8.0	11.4
9-17	B ₂	0.6	0.3	0.2	0.2	16.9	18.2	5.2	2.46	11.9	25.9	42.4	10.7	11.6	5.2	8.9	9.3
17-30	B ₃	0.5	0.2	0.1	0.1	13.4	14.3	5.4	1.40	11.8	22.8	36.3	9.5	10.1	5.0	10.4	16.9
30-32	MC	0.3	0.2	0.1	0.1	12.0	12.7	5.6	0.96	6.2	21.2	37.0	11.9	12.5	6.2	12.4	13.8
32-42	C	0.1	<0.1	0.1	0.1	8.5	8.8	5.8	0.21	6.9	21.2	36.8	12.0	13.7	7.1	12.5	11.0

Clallam gravelly loam

Collectors: Fowler, Kilmer, Leighty, Roberts, and Wheeting, June 10, 1950, 4:30 p.m. to 7:00 p.m.

Location: Clallam County, Washington, NW 1/4 NW 1/4 sec. 14, T. 30 N., R. 5 W., or about 2 miles west of Agnew, Washington.

Elevation: 100-300 feet.

Relief: Gently sloping hillside with many cradle knolls and swales. Very little evidence of sheet erosion.

Vegetation: Dominantly Douglas fir, western red cedar, and undergrowth of salal, ferns, and a few roses. Some fallen trees, but not nearly so pronounced as on the Shelton soils. Typical cedar tree 7 inches in diameter is 40 feet high and 75 years old. A fir tree 13 inches in diameter is 110 feet high and 90 years old. Site rating of about 4. Where sample was collected the site was nearly free of moss. In general on good sites cedar cannot compete with fir, but owing to the slow growth of the trees on this poor site, cedar competes with the Douglas-fir. There is no evidence of this area being burned, at least in recent times; and there are about 4 cedar trees to 5 fir trees. Trees are about 10 feet apart.

Drainage: Soil appears to be well drained to the indurated till. Moderate internal drainage, moderate to rapid infiltration, moderate permeability. The permeability may be somewhat restricted due to the slight brittleness of the soil material above the indurated till.

Parent material: Glacial deposits of the Vashon glaciation.

Biological activity: Some large black ants and other insects. Many mosquitoes.

Climate: At Sequim, which is approximately 10 miles east and has an elevation of 187 feet, the January average temperature is 37.6° F., July average is 58.8° F., and growing period is 184 days. For a period of 22 years the mean annual precipitation was 16.39 inches, divided as follows: January 2.28, February 1.38, March 1.33, April 1.02, May .77, June .78, July .47, August .57, September .98, October 1.57, November 2.03, and December 3.21. Average annual snowfall is 7.9 inches. The precipitation at the sample site is probably about 4 inches higher than at Sequim or about 20 inches, and the frost-free period is probably about 200 days. At sample site at 5:00 p.m. temperature is 61° F. in the shade, 54° F. at 3 inches below the surface, and 50° at 30 inches.

Profile: S50-Wn-5-1

S50-Wn-5-1-1

A₀₁ 1 1/4-1/4" F layer of dominantly loose to very friable leaf mat of very dark brown, moderately decomposed fir and cedar needles; pH 5.0. Grades into:

S50-Wn-5-1-2

A₀₂ 1/4-0" H layer of very dark gray, decomposed organic material; pH 5.2.

S50-Wn-5-1-3

A₂₁ 0-1" Light-gray (10YR 7/1), very friable fine sandy loam that is massive to single grain or very fine crumb; when wet, gray to grayish-brown (10YR 5/1.5) and very slightly plastic; pH 5.2.

S50-Wn-5-1-4

A₂₂ or 1-4" Light-gray (10YR 7/1.5), slightly hard or brittle loam or fine sandy loam with few fine pebbles and some light yellowish-brown (2.5Y 6/3) staining, especially within lumps; few to very few shot; when moist,

firm and dark grayish brown to grayish brown (10YR 4.5/2) with brown (10YR 4/3) staining; very weak, subangular, blocky to, in places, very weak platy; pH 5.2. In places 1 or 2 inches of faintly cemented ortstein.

S50-Wn-5-1-5

B₁ 4-8" Mostly light-gray (10YR 7/2) with variegations of pale brown (10YR 6/3) to light yellowish brown (2.5Y 6/3), weak, medium-and fine-subangular, blocky, coarse-textured loam that is slightly gravelly, and contains some shot, some of which have very small, black, manganese concretions within; aggregates mostly pale brown to light yellowish brown inside and coated light gray; when moist, mostly grayish brown (10YR 5/2) with brown (10YR 4/3) to olive-brown (2.5Y 4/3) variegations outside and within aggregates; brittle; pH 4.9.

S50-Wn-5-1-6

B₂ 8-18" Friable, coarse-textured loam to fine sandy loam that is slightly gravelly; apparently hard, weak, medium-and fine subangular, blocky; mostly light yellowish brown (2.5Y 6/3) within aggregates, but much light gray (2.5Y 6.5/2) between lumps and few brown to strong-brown splotches; when moist, olive brown (2.5Y 4/3) within lumps and grayish brown (10YR 4.5/2) between; pH 5.0-5.2. Roots fairly numerous, but not so thick as in the 1 to 8 inch layers.

S50-Wn-5-1-7

B₃ 18-32" Light-gray (2.5Y 7/2 to 5Y 7/2) and light yellowish-brown (2.5Y 6/3) to pale-brown (10YR 6/3), firm or hard, somewhat brittle, weak, medium subangular, blocky, coarse-textured fine sandy loam that is slightly gravelly; when moist, dark grayish brown (2.5Y 4/2) to olive gray (5Y 4/2) and olive brown (2.5Y 4/3); very few brown to reddish-brown streaks; pH at 18 inches 5.6, at 20 inches 5.8, at 22 inches 6.6, at 24 inches 6.7. Possibly faintly cemented.

S50-Wn-5-1-8

C₁ 32-40" Faintly mottled or streaked light brownish-gray (10YR 6/2), light-gray (2.5Y 7/1), light yellowish-brown (10YR 6/4), light olive-brown (2.5Y 5/3), and yellowish-brown (10YR 5/4), firm or brittle, massive, slightly gravelly, coarse-textured fine sandy loam; when moist, grayish brown (2.5Y 5/2), gray (2.5Y 5/1), and olive brown (2.5Y 4/3); pH 6.7. Possibly faintly cemented.

S50-Wn-5-1-9*

C₂ 40-46" Light brownish-gray (2.5Y 6/2) to light-gray (2.5Y 7/2), hard, massive fine sandy loam with few pebbles and few light yellowish-brown (2.5Y 6/3 and 10YR 6/4) mottlings and streaks; when moist, grayish brown (2.5Y 5/2) to olive gray (5Y 5/2) with light olive brown (2.5Y 5/4) mottlings; pH 5.2. Some spots of clay loam. Possibly very weakly cemented.

Remarks: The roots appear to be evenly distributed from 0 to 18 inches, but rapidly decrease below that depth. The pebbles throughout the profile are silica coated. All layers appear to be somewhat brittle. No distinct structure but some vertical pinholes. There appear to be some manganese specks in all layers. Most of the layers are mottled with either shot or iron concretions. The pebbles are mostly basic, but some are granite. The pebbles in the till appear to be clean, and the soil is coarse.

Clallam gravelly loam

Clallam Co., Washington

(Gray-Wooded)

S50Wn-5-1-1 to 1-9

Lab. Nos. 501183 to 1191

Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	VCS	
1 1/4-1/4	A ₀₁	--	--	--	--	--	--	--	--	4.7	--	--	--	--	--	--	--	--	--
1/4-0	A ₀₂	--	--	--	--	--	--	--	--	5.2	--	--	--	--	--	--	--	--	--
0-1	A ₂₁	4.8	0.7	0.4	0.1	8.3	14.3	42	4.8	1.84	4.5	23.0	45.4	13.2	19.0	9.2	6.0	2.7	
1-4	A ₂₂	3.4	0.6	0.4	0.1	10.6	15.1	30	4.9	1.22	6.1	23.0	45.0	12.5	17.7	8.8	6.3	3.6	
4-8	B ₁	2.6	0.6	0.4	0.1	8.3	12.0	31	5.2	0.76	5.8	22.3	44.0	12.1	17.9	9.1	6.8	4.3	
8-18	B ₂	3.0	0.8	0.4	0.1	8.2	12.5	34	5.3	0.51	6.4	20.8	39.7	12.0*	19.8	9.9	7.7	4.5	
18-32	B ₃	3.0	1.1	0.2	0.1	2.7	7.1	62	5.8	0.10	5.4	10.0	22.8	13.1	29.2	15.4	9.8	4.3	
32-40	C ₁	2.5	1.5	0.2	0.1	2.3	6.6	65	6.0	0.09	6.8	8.5	23.3	17.7	30.7	12.9	6.3	2.3	
40-46	C ₂	3.0	2.1	0.2	0.2	2.5	8.0	69	5.6	0.11	8.0	11.3	25.5	16.3	28.0	12.4	6.7	3.1	

Clallam loam

Collectors: Fowler, Kilmer, Leighty, Roberts, and Wheeting, June 11, 1950, 12:00 noon to 3:00 p.m.

Location: Clallam County, Washington, NW 1/4 NW 1/4 sec. 28, T. 30 N., R. 2 W., or about 6 1/2 miles east of Sequim. Sample collected under a fir and madrone. Fairly easy to dig.

Elevation: 450 feet.

Relief: Gently sloping till plain, 8 percent slope. Very little evidence of erosion.

Vegetation: Douglas-fir and madrone with an understory of rhododendron, salal, and Oregon grape. Has appearance of being a little drier site than the other sample of Clallam. One fir 12 inches in diameter is 24 years old and 60 feet tall. Another fir 5 1/2 inches in diameter is also 24 years old. No cedars in the vicinity.

Drainage: Similar to other sample of Clallam. Soil appears to be well drained to the indurated till. Moderate internal drainage, moderate to rapid infiltration, moderate permeability. The permeability may be somewhat restricted, owing to the slight brittleness of the soil material above the indurated till. There appears to be few or no swales or seep spots.

Parent material: Glacial deposits of the Vashon glaciation.

Biological activity: Very little observable biological activity.

Climate: At Sequim, which is slightly lower in elevation and about 6 1/2 miles west of sample site and has a similar climate, the January average temperature is 37.6°F., the July average is 58.8°F., and the growing period is 184 days. For a period of 22 years the mean annual precipitation is 16.39 inches, divided as follows: January 2.28, February 1.38, March 1.33, April 1.02, May .77, June .78, July .47, August .57, September .98, October 1.57, November 2.03, and December 3.21. Average annual snowfall is 7.9 inches. Temperature at sample site is 2:00 p.m. was 64°F. in the shade, 54°F. at 3 inches below the surface of the soil, and 50°F. at 30 inches.

Profile: S50-Wn-5-2

S50-Wn-5-2-1

A₀ 1-0" Nearly loose or very friable leaf mat of very dark brown, partly decomposed madrone leaves and fir needles. pH 6.0.

S50-Wn-5-2-2

A₂₁ 0-2" Light brownish-gray (10YR 6/2), very fine crumb to single-grain sandy loam containing a few pebbles; when wet, dark gray (10YR 4/1), non-sticky, and nonplastic; pH 6.9. Water dropped on this material runs off without wetting it.

S50-Wn-5-2-3

A₂₂ 2-5" Light-gray (10YR 7/1), very fine crumb to single-grain sandy loam that is slightly to moderately gravelly; when wet, dark grayish brown (10YR 4/2), nonplastic, and nonsticky; pH 5.2.

S50-Wn-5-2-4

B₁ 5-10" Pale-yellow (2.5Y 7/3) (especially within lumps) and light gray (2.5Y 7/1), very weakly nuciform gravelly or slightly gravelly sandy loam; few shot, but most of the particles larger than 1 mm. appear to be soil and iron-coated, weathered, fine pebbles; when wet, yellowish brown to light olive brown and grayish brown (2.5Y 5/2), nonsticky, and nonplastic; pH 5.3.

S50-Wn-5-2-5

B₂ 10-20" Light yellowish-brown (2.5Y 6/3) to pale-brown (10YR 6/3), especially within lumps, and light-gray (2.5Y 7/2), very weak, subangular, blocky gravelly or slightly gravelly sandy loam; when wet, light olive brown (2.5Y 5/3) to brown (10YR 4/3) and grayish brown (2.5Y 5/2), non-sticky, and nonplastic; possibly few shot; pH 5.9.

S50-Wn-5-2-6

C₁ 20-31" Light-gray (2.5Y 7/1 .5 to 5Y 7/2), hard, massive, weak or very weak, cemented, coarse-textured, gravelly sandy loam, weathered till with some distinct light yellowish-brown mottlings; nonsticky, nonplastic, and grayish brown to olive brown (2.5Y 4.5/2 .5) with yellowish-brown mottlings when wet; firm; some vesicles; pebbles are basic; pH 6.0.

S50-Wn-5-2-7

C₂ 31-36" Light-gray (2.5Y 7/1), hard, massive, slightly gravelly fine sandy loam, weathered till with some distinct light olive brown (2.5Y 5/3) and light yellowish-brown (10YR 6/4) and very few brown (7.5YR 5/4) mottlings; when wet, gray (2.5Y 6/1) mottled with light brownish gray (2.5Y 6/2), light yellowish brown (2.5Y 6/3), olive brown (2.5Y 4/3), and brown (7.5YR 4/4); pH 6.2. The yellowish material appears to have slightly more clay than the light-gray material.

Remarks: Roots are dense in the leaf mat and are fairly uniformly distributed to a depth of 20 inches, but there are very few below that depth. All layers are brittle and mottled with iron concretions, most of which are rounded and hard, but there are some splotches of iron. The layer at about 20 inches, which appears to stop the roots, is firm and brittle, but it can be readily crushed between the fingers. Pebbles are slightly silica coated, with an underlying layer of reddish ortstein-like material.

Ten pounds in the 0 to 10 inch layer contained 25 percent material larger than 2 mm. in diameter, which was mostly rounded shot concretions. About 25 percent of the material was angular and rounded gravel. Below 20 inches, in 8 pounds of material 1/2 pound was between 2mm. and 1/4 inch, 1/2 pound was between 1/4 inch and 1/2 inch, and 1 1/2 pounds were 1/2 inch larger. Most of the shot in this profile appears to be soft and between 2 mm. and 1/4 inch in diameter. Pebbles below 20 inches are fairly clean, dark colored, and rounded.

This profile is not as typical as other sites of the Clallam soil. It appears to be more like a Podzol. In other sites the soil appears to be slightly heavier textured and a little more mottled, even though originating from a sandy till.

S50Wn-5-2-1 to 2-7

Lab. Nos. 501192 to 11198

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %						
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	VCS
1-0	A ₀	--	--	--	--	--	--	--	5.4	--	--	--	--	--	--	--	--
0-2	A ₂₁	7.8	2.2	0.6	0.1	7.3	18.0	59	5.8	2.27	4.4	16.0	29.8	9.9	21.4	14.2	6.0
2-5	A ₂₂	2.0	0.8	0.4	0.1	5.2	8.5	39	5.4	0.83	4.7	15.9	30.3	9.6	21.2	14.3	5.8
5-10	B ₁	1.7	0.8	0.4	0.1	4.5	7.5	40	5.4	0.59	4.7	15.9	29.0	9.3	20.8	15.0	5.9
10-20	B ₂	1.4	1.1	0.3	0.1	3.8	6.7	43	5.4	0.43	4.4	13.4	25.3	9.3	23.0	16.0	7.0
20-31	C ₁	2.1	1.1	0.2	0.1	2.3	5.8	60	6.0	0.16	4.4	12.4	23.4	10.0	25.1	16.6	5.3
31-36	C ₂	3.0	1.5	0.2	0.2	2.0	6.9	71	5.8	0.14	5.7	14.2	28.1	14.4	25.6	13.8	2.9

Whidbey gravelly sandy loam--Podzol

Collectors: Buchanan, Kilmer, Leighty, Ness, Roberts, and Wheeting, June 12, 1950, 11:00 a.m. to 2:00 p.m.

Location: Island County, Washington, NW 1/4 NW 1/4 sec. 15, T. 29 N., R. 3 E. or 2 miles south of Langley. Sample collected under Douglas fir.

Elevation: About 500 feet.

Relief: Gently undulating till plain, 3 percent slope.

Vegetation: Douglas fir, few young cedar trees, and understory of huckleberries, rhododendron, salal, fern, and Oregon grape. Fir 8 1/2 inches in diameter, 75 feet tall, 75 years old. Trees are fairly numerous but grow very slowly.

Drainage: Well to excessively drained. Rapid internal drainage, rapid infiltration, rapid permeability. Appears to be little or no runoff and no erosion.

Parent material: Glacial till from Vashon glaciation. Mixed materials.

Biological activity: Little or no insects observed. Rather striking yellow mycelia in the leaf mat.

Climate: At Everett, 10 miles east, the January average temperature is 38°F., the July average 61.2°F., and the growing period 213 days. For a 24-year period the average annual precipitation was 32.74 inches, divided as follows: January 4.56, February 3.14, March 3.47, April 2.45, May 1.99, June 1.63, July .78, August 1.00, September 1.89, October 3.01, November 3.78, and December 5.04. Average annual snowfall was 10.8 inches. The precipitation at the sample site is considerably less than that at Everett, but more than at Coupeville, which is approximately 20 miles northwest. The average annual precipitation at Coupeville is 18.77 inches. At sample site air temperature was 55°F., at 3 inches below the surface of the soil 54°F., and at 30 inches below surface of the soil 50°F.

Profile: S50-Wn-15-1

S50-Wn-15-1-1

A ₀	1-0"	Nearly loose to very friable leaf mat of very dark gray or very dark brown, partly decomposed fir needles and some yellow and white mycelia; pH 4.4. Roots very pronounced in the H layer.
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S50-Wn-15-1-2

A ₂	0-2"	Light-gray (10YR 7/1), siliceous, single-grain sandy loam; gray (10YR 5/1) and very friable when moist; nonsticky and non-plastic; pH 5.0. Appears to be higher in silt than horizon below. No shot. Very uneven in thickness, ranging from 1/6" to 2 inches. No mycelia penetrate this layer. Rather abrupt change to:
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S50-Wn-15-1-3

B _{2ir}	2-5"	Pale-brown (10YR 6/3) to very pale brown (10YR 7/3), firm, slightly iron-cemented, gravelly sandy loam ortstein with considerable shot; brown (7.5YR 5/4) to dark brown (10YR 4/3) when moist. Single-grain when crushed; pebbles yellowish-brown iron-coated; pH 5.5.
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S50-Wn-15-1-4

B _{2cn}	5-11"	Horizon of greatest shot accumulation; pale-brown (10YR 6/3) to very pale brown (10YR 7/3), nonplastic, single-grain very gravelly sandy
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loam; brown (7.5YR 5/4) to dark brown (10YR 4/3) and friable when moist; pebbles yellowish-brown iron-coated; pH 6.2.

S50-Wn-15-1-5

B₃₁ 11-18"

Pale-yellow (2.5Y 7/3) to pale-brown (10YR 7/3), nearly loose or very friable very gravelly sandy loam or loamy sand; olive brown (2.5Y 4/3), nonsticky, and nonplastic when wet; pH 6.4.

S50-Wn-15-1-6

B₃₂ 18-29"

Light-gray (10YR 7/2), nearly loose or very friable very gravelly loamy sand or sandy loam; light olive brown to olive brown (2.5Y 4.5/3) and nonplastic when wet; pH 6.5 at 20 inches, 6.8 at 24 inches.

S50-Wn-15-1-7

C_m 29-36"

Light-gray (2.5Y 6/1), coarse-textured sandy loam or loamy sand, cemented till with very few, faint, light brownish-gray and light yellowish-brown mottlings; no shot and much less gravelly than above; pH 6.4. Top of till silica coated over rusty-brown iron-stained material, which grades into the light-gray till.

Remarks: Striking features of this profile are a distinct A₂ horizon and a firm iron-stained B₂ horizon, with a distinct root mat resting on semi-indurated gray till. Gravel and rocks are mostly basaltic, but many are crystalline and granitic. In 7 pounds of the material obtained between 2 and 10 inches, 2 pounds of material were between 2 mm. and 1/4 inch, 1 3/4 pounds were between 1/4 and 1/2 inch, and 3/4 pound was larger than 1/2 inch. In the 15 to 25 inch layer 56 percent was larger than 2 mm. Of 7 1/2 pounds of material 1 pound consisted of material between 2 mm. and 1/4 inch, 1 pound was shot between 1/4 and 1/2 inch, and 1 1/4 pounds were larger than 1/2 inch, or 50 percent larger than 2 mm.

S50Wh-15-1-1 to 1-7

Lab. Nos. 501199 to 1205

Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %						
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	VSC
1-0	A ₀	--	--	--	--	--	--	--	4.2	--	--	--	--	--	--	--	--	--
0-2	A ₂	1.0	0.4	0.1	0.1	5.8	7.4	22	4.3	1.96	2.7	16.2	28.0	12.1	23.0	14.8	13.3	6.1
2-5	B ₂ ir	1.6	0.5	0.1	0.1	7.0	9.3	25	5.6	0.73	7.1	14.2	23.1	9.3	22.3	16.6	15.3	6.3
5-11	B ₂ en	1.3	0.3	0.1	0.1	4.6	6.4	28	5.8	0.49	6.2	12.5	20.2	9.3	24.9	18.2	15.8	5.4
11-18	B ₃ l	1.2	0.4	0.1	0.1	3.8	5.6	32	5.8	0.41	5.9	11.5	17.9	9.6	27.6	19.8	15.0	4.2
18-29	B ₃ 2	1.2	0.3	0.1	0.1	2.9	4.6	37	6.1	0.21	5.0	8.1	13.0	8.8	26.9	21.0	18.8	6.5
29-36+	MC	1.2	0.7	0.2	0.2	1.8	4.1	56	6.4	0.04	5.2	7.3	12.1	9.4	26.3	19.4	19.2	8.4

Whidbey gravelly sandy loam--Podzol

Collectors: Buchanan, Kilmer, Leighty, Ness, Roberts, and Wheeting, June 12, 1950, 4:30 to 6:00 p.m.

Location: Island County, Washington, SW 1/4 NW 1/4 sec. 26, T. 29 N., R. 3 E., or 2 miles west of Clinton.

Elevation: 440 feet.

Relief: Gently undulating till plain, 3 percent slope. Not very many cradle knolls. Surface very irregular microrelief, but the overall slope is nearly level.

Vegetation: Douglas fir, hemlock, cedar, and understory of ferns, huckleberries, salal, rhododendron and moss. Hemlock 71 years old, 16 1/2 inches in diameter. Fir 75 years old, 11 inches in diameter. Cedars 150 years old, 24 inches in diameter. One very old dead fir 20 inches in diameter was 350 years old; in its first 65 years it was 14 inches in diameter. Much down timber.

Drainage: Well to excessively drained. Rapid internal drainage, rapid infiltration, rapid permeability. Appears to be little or no runoff and no erosion.

Parent material: Glacial till from Vashon glaciation. Mixed materials.

Biological activity: Little or no insects observed. Rather striking yellow mycelia in the leaf mat.

Climate: At Everett about 10 miles to the east, the January average temperature is 38° F., the July average 61.2° F., and growing period 213 days. For a 24-year period the average annual precipitation was 32.74 inches, divided as follows: January 4.56, February 3.14, March 3.47, April 2.45, May 1.99, June 1.63, July .78, August 1.00, September 1.89, October 3.01, November 3.78, and December 5.04. Average annual snowfall was 10.8 inches. Air temperature at 4:30 p.m. at sample site was 64° F., at 3 inches below the surface of the soil 54° F., at 30 inches 50° F.

Profile: S50-Wn-15-2

S50-Wn-15-2-1

A ₀	1-0"	Loose or very friable leaf mat consisting mostly of very dark brown or very dark gray, partly decomposed moss and hemlock needles; fine yellowish mycelia; pH 4.6.
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S50-Wn-15-2-2

A ₂	0-1"	Light-gray (10YR 7/1), vesicular, friable, nonplastic fine sandy loam; dark grayish brown to grayish brown or gray (10YR 4.5/1.5) when moist; lots of quartz; pH 4.8. When a drop of water falls on the powdered material, it rolls off without wetting the soil. Abrupt change to layer below:
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S50-Wn-15-2-3

B ₂ ir	1-4"	Pale-brown (10YR 6/3), gravelly sandy loam ortstein; definitely cemented in the upper part, but lower part looser. Not so many shot as in the other sample of Whidbey, but considerable iron-coated gravel; soil aggregates are iron coated. Dark brown (10YR 4/3) when moist; pH 5.2.
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S50-Wn-15-2-4

B₂₂ 4-10" Light yellowish-brown (10YR 6/4) very gravelly sandy loam with some iron splotches and a few yellow, brown, and gray mottlings; olive brown (2.5Y 4/3) when moist; pH 5.7.

S50-Wn-15-2-5

B₃ 10-20" Distinctly grayer or rather mixed light-gray and pale-yellow, firm very gravelly sandy loam with bright iron mottlings; pH 6.2. In places this material is semicemented, but crushes readily between the fingers.

S50-Wn-15-2-6

C_m 20-31" Light-gray (2.5Y 7/1), coarse-textured gravelly sandy loam, cemented till with pale-yellow, light yellowish-brown, and yellowish-brown mottlings; olive brown when moist; pH 6.7.

S50-Wn-15-2-7

C 31-42" Light-gray (2.5Y 6.5/1), gravelly loamy sand, somewhat cemented till with some large distinct pale-yellow and light-yellowish-brown mottlings; firm but easy to dig. When wet, gray to light gray with light yellowish-brown and light olive-brown mottlings; top part is very hard; pH 6.8.

Remarks: Very few roots below 20 inches. Top of the till has light-gray and strong-brown thin layers over the yellow and gray material. Gravel in lower part of the profile is fairly clean, but the pebbles in the upper part are iron coated. Most of the gravel is basic, dominantly andesitic, possibly some serpentine but also considerable granite. In 9 1/2 pounds of the lower part of the profile, 7 1/4 pounds consisted of material larger than 2 mm., 6 pounds were larger than 1/4 inch, and 4 1/4 pounds were larger than 1/2 inch. In upper part of the profile in 9 pounds of soil, 5 pounds consisted of material larger than 2 mm., 4 pounds were larger than 1/4 inch, and 1 3/4 pounds were larger than 1/2 inch.

S50Wn-15-2-1 to 2-7

Lab. Nos. 501206 to 1212

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	OS	VCS
1-0	A ₀	--	--	--	--	--	--	--	4.2	--	--	--	--	--	--	--	--	--
0-1	A ₂	1.2	0.4	0.1	0.1	7.8	9.6	19	4.4	1.62	3.7	21.7	39.6	14.1	18.7	10.0	9.3	4.6
1-4	B _{2ir}	1.9	0.6	0.2	0.1	10.3	13.1	21	5.3	0.98	7.9	17.5	31.4	11.5	18.4	10.9	11.7	8.2
4-10	B ₂₂	2.3	0.6	0.2	0.1	6.1	9.3	34	6.1	0.50	5.9	16.4	30.9	12.5	20.3	11.7	11.9	6.8
10-20	B ₃	2.8	0.6	0.2	0.2	4.0	7.8	49	6.4	0.28	5.6	14.9	26.9	11.7	21.6	14.0	13.2	7.0
20-31	C _m	1.6	0.6	0.2	0.1	3.8	6.3	40	6.4	0.20	4.5	11.4	22.5	11.6	24.4	16.3	14.6	6.1
31-42	C	0.7	0.3	0.1	0.1	3.2	4.4	27	6.3	0.12	2.3	7.8	14.8	10.4	27.1	19.6	17.7	8.1

Segal stony gravelly sandy loam--"Brown Forest"

Collectors: Leighty and Roberts, May 2, 1950, 10:00 a.m. to 5:00 p.m., cloudy, some snow. Sample very difficult to collect--it was necessary to use a crowbar on all layers below 10 inches.

Location: Douglas County, Nevada, approximately center sec. 10, T. 12 N., R. 22 E., or 3/4 mile south of Slater Mine in Carson Valley Soil Conservation District. Sample collected under pinon tree on south facing slope.

Elevation: Approximately 7,800 feet.

Relief: Steeply sloping fan or old terrace, approximately 22 percent. Many large boulders on the surface as well as in the profile.

Vegetation: Dominantly pinyon pine, some juniper, big sagebrush, and bitterbrush, some lupine, and grass. Pinon approximately 30 feet apart, 6 to 8 inches in diameter, 12 feet high, and 25 to 30 years old. Juniper approximately 6 feet high and about 1/20 as numerous as the pinon. Each tree shades an area of about 16 feet in diameter.

This site appears to be about at timber line, especially for north facing slopes, as very few trees are growing above 8,000 feet. In some places vegetation is quite dense, whereas in other areas it is very open, with mostly sagebrush. Approximately 15 percent of the area is barren.

Drainage: Well drained; very little surface runoff under the trees, moderate internal drainage to the compact subsoil, then slow. Rapid infiltration, moderately rapid permeability.

Parent material and age: Mixed acid igneous rocks, dominantly rhyolitic. This appears to be a very old landscape. Possibly it has been formed from mountain glaciation, but it is more likely to be an old river terrace or alluvial fan.

Biological activity: Considerable mold and fungi under the trees and to some extent under the sagebrush. Some ants, but no earthworms. The ants have very small hills. Some moss and algae on the rocks.

Climate: Near Lamoille in Elko County, Nevada, which is approximately 700 feet lower in elevation and approximately 270 miles northeast, but which appears to have about the same kind of climate and vegetation, the January average temperature is 25.7°F., the July average is 68.2°F., with 117 days growing season. Mean annual precipitation for a 34-year period is 16.16 inches, divided as follows: January 1.47, February 1.72, March 1.82, April 2.08, May 2.05, June 1.05, July .75, August .66, September .66, October 1.39, November 1.15, December 1.36. No record of snowfall, but would estimate approximately 80 inches. Yearly evaporation approximately 40 inches.

Profile: S50-Nev-3-1

S50-Nev-3-1-1

A₀ 1-0" Very dark grayish-brown (10YR 3/2) loose mat of decayed and partially decayed pinon needles. Some fungi, which appear to accumulate in local areas or nests. Rests directly on:

S50-Nev-3-1-2

A₁₁ 0-2" Dark grayish-brown (10YR 4/2; very dark grayish-brown, 10YR 3/2 moist), loose, gravelly, friable sandy loam, very slightly plastic. Noticeable amount of loose, slightly decomposed gravels and angular chips on the surface and in this horizon. Also some angular cobbles 5 inches or larger. Rocks are fine grained, crystalline, and consist of feldspar, quartz, and hornblende. The rocks look very old. Roots not particularly noticeable. Gradual change to:

S50-Nev-3-1-3

A₁₂ 2-4" Grayish-brown (10YR 5/2; very dark grayish-brown, 10YR 3/2, moist), weak, granular, gravelly sandy loam. The granules are very thinly coated with gray siliceous material indicating a slight tendency for an A₂ development. This layer may be considered to be a perched water table. This seems to be the layer of greatest root concentration. Gradual change to:

S50-Nev-3-1-4

B₁ 4-10" Dark brown (10YR 4/3; dark brown, 10YR 3/3, moist), firm, granular, slightly plastic gravelly loam. This layer is contrasting in color and texture to layer above. Roots plentiful, some 1/16 inch in diameter. This layer may be an A₃ layer rather than a B₁. Abrupt change to:

S50-Nev-3-1-5

B₂₁ 10-16" Brown (10YR 4/3; dark brown, 10YR 3/3, moist), dense, plastic, sticky gravelly clay. Structure appears to be ill-defined prismatic or blocky. Very few roots. Not so many gravels as in layer above, but more undecomposed minerals. Gradual change to:

S50-Nev-3-1-6

B₂₂ 16-27" Yellowish-brown (10YR 5/4; dark yellowish-brown, 10YR 4/4, moist), sticky, plastic gravelly clay, weak prismatic to cloddy. Soil appears massive, dense, and compact. Considerable unweathered gravel and sharp angular particles. Gradual change to:

S50-Nev-3-1-7

B₃ 27-32" Yellowish-brown (10YR 5/4; dark yellowish-brown, 10YR 4/4, moist) gravelly clay loam with no distinct structure. Moderately plastic, very few roots, lots of undecomposed minerals. Gradual change to:

S50-Nev-3-1-8

C 32-39"+ Mottled pale brown (10YR 6/3) and yellowish-brown (10YR 5/4), partially decomposed gravelly clay loam or heavy loam. The lighter color materials appear to be the least decomposed and have the color of unweathered gravels.

Remarks: The color and texture indicate that this is a strongly developed soil, probably a maximal or claypan "Brown Forest" of the west. It has a slight tendency to have a perched water table above the B horizon. According to color it is comparable to many of the Chestnut soils, but it is timbered or partially so. It is doubtful, however, if the trees have had a very significant effect on the soil profile. Free lime does not occur in the profile, but this is probably because of the kind and age of the parent material. The pH is about 6.5 in all layers. All layers react with H₂O₂ but layers 2, 3, 4, and 5 react the longest. Aggregates to a depth of 10 inches are fairly stable in water, but below this depth they slake readily when immersed in water. This is a typical sample of a strongly developed profile of the so-called "Brown Forest" of the intermountain region.

Lab. Nos. 501280 to 1287

S50Nev3-1-1 to 1-8

Depth Inches	Horizon	M.E./100 Grams Soil						% O.C.	pH	% B. SAT	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1-0	A ₀	--	--	--	--	--	--	--	4.6	--	--	--	--	--	--	--	--	
0-2	A ₁₁	5.6	1.0	0.8	0.3	2.7	10.4	1.72	6.6	74	7.5	9.4	14.5	6.6	14.4	12.0	25.6	19.4
2-4	A ₁₂	6.8	1.4	0.7	0.1	2.0	11.0	1.07	6.8	82	8.8	10.0	15.4	5.8	12.3	10.4	23.6	23.7
4-10	B ₁	7.4	1.8	0.5	0.1	2.7	12.5	0.69	6.6	78	13.0	10.2	16.6	8.1	14.5	10.5	20.7	16.6
10-16	B ₂₁	11.3	3.8	0.5	0.4	2.5	18.5	0.78	6.3	86	26.9	11.1	17.6	6.1	10.4	7.7	16.4	14.9
16-27	B ₂₂	15.5	5.8	0.4	0.4	4.3	26.4	0.61	6.1	84	35.9	12.7	18.8	4.8	6.8	4.6	11.9	17.2
27-32	B ₃	16.4	6.7	0.4	0.4	4.2	28.1	0.37	6.2	85	35.3	11.1	17.6	6.4	10.2	6.9	12.2	11.4
32-39+	C	14.8	5.9	0.2	0.3	2.7	23.9	0.26	6.3	89	19.8	12.9	21.6	9.0	14.3	8.5	14.8	12.0

Segal fine gravelly sandy loam--"Brown Forest"

Collectors: Leighty and Roberts, May 4, 1950, 2:00 to 6:30 p.m. Partly cloudy and cool. Sample very difficult to collect--it was necessary to use a crowbar on all layers below 10 inches.

Location: Douglas County, Nevada, Carson Valley Soil Conservation District, NW 1/4 SW 1/4 sec. 10, T. 13 N., R. 22 E. on secondary road northeast of the road that goes to Slater Mine. Sample collected on a southwest slope.

Elevation: Approximately 6,300 feet.

Relief: Gently sloping, smooth, 10 percent, old alluvial fan or old river terrace.

Vegetation: Nearly complete coverage of pinon with a few juniper, some understory of big sagebrush and bitterbrush, with some grass. Sample collected under a pinon where there was no underbrush. Trees are approximately 10 feet apart, 12 to 18 feet high, 8 to 10 inches in diameter. Probably most of the trees are 30 to 50 years old. One 10-inch in diameter pinon was 67 years old.

Drainage: Well drained; very little surface runoff under the trees, moderate internal drainage to the compact subsoil, then slow. Rapid infiltration, moderately rapid permeability.

Parent material and age: Mixed acid igneous rocks, dominantly rhyolitic. This appears to be a very old landscape. Possibly it has been formed from mountain glaciation, but it is more likely to be an old river terrace or alluvial fan.

Biological activity: Considerable mold and fungi and some ants.

Climate: Near Lamoille in Elko County, Nevada, which is approximately 800 feet higher in elevation and approximately 270 miles northeast, but which appears to have about the same kind of climate and vegetation, the January average temperature is 25.7°F., the July average is 68.2°F., the growing season is 117 days. Mean annual precipitation for a 34-year period is 16.16 inches, divided as follows: January 1.47, February 1.72, March 1.82, April 2.08, May 2.05, July .75, August .66, September .66, October 1.39, November 1.15, December 1.36. No record of snowfall, but would estimate approximately 80 inches. Yearly evaporation approximately 40 inches.

Profile: S50-Nev-3-2

S50-Nev-3-2-1

A₀₀ 2-3/4" Very dark grayish-brown (10YR 3/2), slightly undecomposed pinon needles. Some fungi. pH 6.0.

S50-Nev-3-2-2

A₀ 3/4-0" Dark brown (10YR 3/3; very dark grayish-brown, 10YR 3/2, moist), decomposed pinon needles. No fungi. pH 6.0. Grades into:

S50-Nev-3-2-3

A₁₁ 0-2" Brown (10YR 4/3; dark brown, 10YR 3/3, moist), very gravelly, slightly plastic light sandy loam. No distinguishable structure. pH 6.6. Roots not very conspicuous. Grades into:

S50-Nev-3-2-4

A₁₂ 2-4 Brown (10 YR 4/3; dark brown, 10YR 3/3, moist), very slightly plastic, very weak, fine granular gravelly sandy loam. This layer when dry has a taint gray siliceous material coating many of the aggregates. pH 7.0. This layer is the layer of greatest concentration of roots. Grades into:

S50-Nev-3-2-5

B₁ 4-9" Brown (10YR 4/3; dark brown, 10YR 3/3, moist), distinct to weak, fine subangular or blocky, moderately to slightly plastic gravelly loam. This layer is browner than the layer above and appears to be B₁ but may be an A₃. pH 7.2. Abrupt change to:

S50-Nev-3-2-6

B₂₁ 9-14" Brown (7.5YR 4/4, dark brown, 7.5YR 3/4, moist), prismatic to blocky, sticky, plastic, stiff gravelly clay with varnished structural aggregates. Some undecomposed minerals. pH 6.6. Gradual change to:

S50-Nev-3-2-7

B₂₂ 14-21" Brown (7.5YR 5/4, dark brown, 7.5YR 4/4, moist), sticky, plastic gravelly sandy clay or sandy clay loam. Some of the large structural aggregates varnished, but not so distinct as in the layer above. pH 6.3. Lots of undecomposed minerals, much more than in layer above. Gradual change to:

S50-Nev-3-2-8

B₃ 21-28" Strong brown (7.5YR 5/6; dark brown, 7.5YR 4/4, moist), sticky, plastic gravelly sandy clay loam. pH 6.3. Lots of undecomposed, sand-sized minerals. Gradual change to:

S50-Nev-3-2-9

C 28-34" About same as layer above; less decomposed minerals. pH 6.7. Soil is brittle and hard; very difficult to dig. All the gravels in the profile are fine.

Remarks: Very few roots below the B₂ horizon, but many very fine roots in the B₂, some 1/4-inch in diameter resting on the B₂ horizon. No evidence of A₂ horizon immediately below the leaf mat, but some indication of A₂ above the B horizon, possibly caused by perched water tables. This site is more densely covered with trees than the other sample of Segal, and should show the effects of timber cover more than the other sample. All layers react with H₂O₂, but layers 3, 4, and 5 have the most active and continuous reaction. Aggregates to a depth of 14 inches are fairly stable in water, but aggregates below 14 inches slake immediately when immersed in water. This profile is typical of the so-called "Brown Forest" of the intermountain region that have well developed profiles. It has a maximal or claypan development. In general it is slightly browner than the other sample of Segal.

S50Nev-3-2-1 to 2-9

Lab. Nos. 501288 to 1296

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
2-3/4	A ₀₀	--	--	--	--	--	--	--	5.1	--	--	--	--	--	--	--	--	--
3/4-0	A ₀	--	--	--	--	--	--	--	5.3	--	--	--	--	--	--	--	--	--
0-2	A ₁₁	5.9	1.8	1.1	0.1	3.5	12.4	72	6.6	1.65	7.2	9.0	19.7	14.3	16.0	8.6	17.0	17.2
2-4	A ₁₂	8.7	3.2	1.8	0.5	1.8	16.0	89	7.3	0.92	10.7	12.8	24.0	12.2	12.8	7.3	17.0	16.0
4-9	B ₁	8.9	3.1	1.3	0.5	2.0	15.8	87	7.0	0.70	14.7	10.4	22.2	15.8	16.5	8.2	13.0	9.6
9-14	B ₂₁	11.4	4.4	0.6	0.6	4.0	21.0	81	6.1	0.63	24.1	8.3	16.7	9.5	12.9	8.1	15.5	13.2
14-21	B ₂₂	11.9	4.9	0.4	0.7	4.2	22.1	81	6.0	0.44	27.6	7.8	16.1	9.9	13.2	7.9	13.7	11.6
21-28	B ₃	10.8	4.3	0.2	0.7	4.0	20.0	80	6.2	0.27	22.3	8.5	17.0	11.3	15.4	8.6	13.5	11.9
28-34+	C	10.8	4.2	0.2	0.7	3.5	19.4	82	6.3	0.21	19.9	9.8	19.5	12.5	15.8	8.6	13.5	10.2

Holyoke stony loam

Collectors: Swanson, Kilmer, Puchalski and Shearin, October 4, 1950.

Location: 2 1/4 miles southeast of Farmington Center in town of Farmington.
At junction of Farmington cut-off and Farmington Avenue.

Vegetation: Hardwood forest of oaks, hickory, ash, black locust, and red maple.

Topography: Southwest slope of about 2% grade.

S50-Conn. 2-10-1

A₀ 1/2-0" Partially decayed leaves and other debris.

S50-Conn. 2-10-2

A₁ 0-3" Very dark grayish brown (10YR 3/2) loam or silt loam; very friable. Has moderate medium and coarse granular structure when dry. Well matted with small roots. Lower boundary is fairly distinct.

S50-Conn. 2-10-3

AB 3-8" Brown (7.5YR 4/4), very friable gritty loam with weak, medium subangular blocky structure. Small rock fragments are numerous. This layer consists of some intermingling of layers above and below it. Lower boundary is fairly distinct.

S50-Conn. 2-10-4

B₂₁ 8-18" Yellowish red (5YR 4/8), friable gritty loam with weak to moderate medium subangular blocky structure. Small rock fragments numerous. This horizon grades into the underlying one.

S50-Conn. 2-10-5

B₂₂ 18-28" Color about same as underlying material. Texture is probably loam, but slightly lighter than material directly above it. Small rock fragments numerous. Lower boundary is fairly distinct.

S50-Conn. 2-10-6

C 28-48" Gritty and gravelly till of coarse sandy loam texture. Small rock fragments mainly of trap (dolerite) make up more than 50% of mass. Material is firm in place when dry, but breaks down very easily when disturbed. Stones on surface and throughout profile are mostly trap rock (dolerite). Small rock fragments are numerous throughout profile.

The soil was very dry when sample was collected so it was difficult to determine texture and structure.

S50Conn-2-10-1 to 2-10-6															Lab. Nos. 511 to 516														
Depth Inches	Horizon	M.E./100 Grams Soil							% B. SAT	pH	% O.C.	Size Classes %																	
		Ca	Mg	K	Na	H	S+	Clay				III	USDA Silt	VFS	FS	MS	CS	VGS											
1 1/2-3	A ₀	--	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--	--										
0-3	A ₁	9.1	1.8	0.4	0.2	28.0	39.5	29	5.3	8.4	13.5	23.8	50.4	12.1	10.0	4.8	5.7	3.5											
3-8	B ₁	0.5	0.2	0.2	0.1	13.1	14.1	7	4.8	1.82	12.4	24.6	53.8	9.6	9.1	4.5	5.9	4.7											
8-18	B ₂₁	0.6	0.1	0.1	0.1	10.0	10.9	8	4.9	0.70	13.0	22.4	52.2	9.1	9.5	5.0	6.2	5.0											
18-28	B ₂₂	0.8	0.3	0.1	0.1	7.4	8.7	15	5.2	0.34	8.4	16.6	39.9	13.5	13.5	6.9	9.0	8.8											
28-40	C	0.4	0.2	0.1	< 0.1	5.2	5.9	12	5.5	0.24	3.6	15.9	37.0	12.3	16.4	8.5	12.2	10.0											

Wethersfield stony loam or silt loam

Collectors: Kilmer, Bourbeau, Puchalski, Downs and Shearin, October 5, 1950. About 1 mile east of Weatogue in town of Simsbury, north of Hwy. 185.

Vegetation: Mixed hardwoods and conifers including oaks, hickory, red maple, gray birch, hemlock and white pine. Shrubs include mountain laurel, blueberry, and greenbrier.

Topography: Sample was collected on nearly level ridge. Topography of general area rolling to hilly.

S50-Conn-2-11-1

A₀ 1-0" Partially decomposed leaf litter.

S50-Conn-2-11-2

A₁ 0-1/2" Very dark brown (10YR 7/2) loam or very fine sandy loam well matted with tree roots; very friable; weak, medium and coarse granular structure.

S50-Conn-2-11-3

A₂ 1/2-1" Light reddish-brown (5YR 6/3) loam or very fine sandy loam; very friable. Very weak, fine and medium platy; contains a small amount of gritty material.

S50-Conn-2-11-4

B₁ 1-6" Reddish-brown (5YR 4/4) loam or silt loam; very friable. Weak, medium subangular, blocky with some suggestion of very weak, platy structure. Some small rock fragments and gritty material present. Lower boundary fairly distinct.

S50-Conn-2-11-5

B₂₁ 6-18" Red (2.5YR 3/6) loam with considerable gritty material. Weak to moderate, medium subangular blocky structure. Slightly plastic when wet. Fine pin holes numerous. This horizon grades into underlying one.

S50-Conn-2-11-6

B₂₂ 18-24" Color same as the overlying material. The material is loam, but probably slightly heavier than overlying horizon. Friable to firm with weak to moderate, subangular, blocky structure. Lower boundary is fairly distinct.

S50-Conn-2-11-7

C₁ 24-36" Dusky red (10R 3/4) till of gritty loam texture; very firm or compact; hard when dry; massive in place but breaks out into irregular fragments. Coatings of manganese dioxide are present on some of the breakage faces. Very few roots penetrate this horizon. The till is derived mainly from Triassic sandstone and shale.

S50-Conn-2-11-8

C₂ 15 feet This sample was taken out of a pit about 50 feet from where the sample was collected. The color is dusky red (10R 3/4) and of gritty clay loam texture. It is very firm or compact when moist, and hard when dry.

Surface stone consists of red sandstone and trap rock (dolerite) in about equal proportions. Rock fragments and stone throughout profile are mainly sandstone and shale.

Lab. Nos. 517 to 5114

S50Conn-2-11-1 to 2-11-8

Depth Inches	Horizon	M.E./100 Gram Soil						% B. SAT	pH	% O.C.	Size Classes %						
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS
1-0	A ₀	--	--	--	--	--	--	--	5.8	--	--	--	--	--	--	--	--
0-1/2	A ₁	4.4	1.1	1.4	0.2	70.8	77.9	9	4.2	26.8	--	--	--	--	--	--	--
1/2-1	A ₂	0.5	0.3	0.5	0.1	35.9	37.3	4	4.2	7.0	12.4	24.1	48.2	15.2	8.9	3.9	6.0
1-6	B ₁	0.2	0.1	0.2	< 0.1	15.5	16.0	3	4.6	2.33	14.3	26.6	53.5	11.6	8.1	3.5	4.6
6-18	B ₂₁	0.1	< 0.1	0.1	< 0.1	13.2	13.4	1	4.8	0.39	11.1	20.6	41.8	13.7	11.0	5.2	8.4
18-24	B ₂₂	0.1	0.1	0.1	< 0.1	6.2	6.5	5	4.6	0.23	10.1	20.9	42.1	14.5	12.3	5.6	8.2
24-36	C ₁	4.4	2.1	0.1	0.2	3.3	10.1	67	5.2	0.04	15.8	21.5	42.0	13.5	11.0	4.8	6.9
15 ft.	C ₂	20.4	1.1	0.2	0.3	0.0	22.0	100	7.8	0.05	24.6	24.6	43.8	9.3	8.5	3.7	5.4

Holyoke stony loam

Collectors: Shearin, Gamble, and Downs, December 7, 1950.

Location: Hampden Co., Mass., one mile N. W. of Soldiers Home in Holyoke, along road that crosses Sheldon Hill. The soils are generally shallow over trap bedrock in this vicinity; however, the area sampled is representative of the Holyoke in Hampden Co.

Topography: Gently sloping to sloping. Sample collected on west slope of about 3 percent gradient.

Vegetation: Cut-over forested area consisting mainly of oaks with some red maple, white birch, gray birch, hemlock and red cedar.

S50-Mass.-7-1-1

A₀ 1/2-0" Partially decomposed leaf litter.

S50-Mass.-7-1-2

A₁ 0-1/2" Very dark grayish brown (10YR 3/2) light loam; soft and spongy, well matted with small roots, and fairly high in content of organic matter. Weak, medium granular structure. A very thin, gray (podzol) layer is present between this horizon and the one underlying it.

S50-Mass.-7-1-3

A₂ or 1/2-3" Dark yellowish brown (10YR 4/4), light loam that contains a small amount of gritty material. Friable. Slightly sticky when wet.
A₃ Very weak, medium subangular, blocky structure. This horizon grades into the underlying material.

S50-Mass.-7-1-4

B₂₁ 3-16" Dark brown (7.5YR 4/4-5/6), friable loam with a silty feel. Slightly sticky when wet. Weak, medium and coarse subangular, blocky structure. Small amount of medium and coarse sand and numerous angular rock fragments, mainly trap, are present. The boundary between this horizon and the underlying one is not distinct.

S50-Mass.-7-1-5

B₂₂ 16-28" Dark brown (7.5YR 4/4) to reddish brown (5YR 4/4) loam with a silty feel; feels slightly heavier than overlying horizon. It is friable when moist, and slightly sticky when wet; structure is weak, medium subangular, blocky. The lower boundary is fairly distinct.

S50-Mass.-7-1-6

C 28-48" Reddish brown (5YR 4/4), coarse, gritty till of light, coarse sandy loam or loamy coarse sand texture; loose and very friable. Small angular and rounded rock fragments make up more than 50% of mass; fragments are mainly trap with small amount sandstone.

Surface stone and boulders are mainly trap (dolerite or basalt). Angular rock fragments, mainly of trap, but with some sandstone, gneiss, are numerous throughout the profile. Also, some stone 12"-24" in diameter were present.

S50Mass-7-1-1 to 7-1-6

Lab. Nos. 5115 to 5120

Depth Inches	Horizon	M.E./100 Grams Soil							pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+	Clay			III Silt	USDA Silt	VFS	FS	MS	CS	VCS	
1/2-0	A ₀	--	--	--	--	--	--	--	4.5	--	--	--	--	--	--	--	--	--
0-1/2	A ₁	0.6	0.6	0.9	0.1	26.6	28.8	8	4.2	8.9	9.1	21.6	53.7	17.1	8.4	3.9	5.0	2.8
1/2-3	A ₂	0.2	0.4	0.7	0.1	17.5	18.9	7	4.6	3.42	10.5	21.8	56.6	16.7	6.3	3.3	4.4	2.2
3-16	B ₂₁	0.2	0.3	0.5	0.1	9.3	10.4	10	4.7	1.00	10.2	22.8	57.9	18.7	5.2	2.7	3.4	1.9
16-28	B ₂₂	0.1	0.3	0.3	0.1	10.3	11.1	7	4.8	0.61	12.2	20.0	52.6	14.8	7.0	4.2	5.7	3.5
24-48	C	0.2	0.2	0.2	0.1	3.5	4.2	17	5.6	0.14	4.1	7.7	17.1	9.2	21.7	14.5	20.4	13.0

Holyoke stony loam

Collectors: Shearin and Quakenbush, Fall 1950

Location: Essex Co., N. J., Livingston Twn., near Roseland, or west side of Laurel Road, 1.2 miles S. W. of Junction with Eagle Rock Rd. Area sampled was just south of Towaco on shallow soils over trap rock.

Topography: Gently rolling to rolling; sample collected on S. W. slope of 2-3% grade.

Vegetation: Cut-over area. Mainly oaks, including white, red and black oak, with some red maple and gray birch.

S50NJ-7-1-1

A₀ 1/2-0" Partially decomposed leaf litter.

S50NJ-7-1-2

A₁ 0-1/2" Very dark grayish brown (10YR 3/2) loam; soft and spongy and well matted with small roots. Structure is weak, medium granular. Lower boundary distinct.

S50NJ-7-1-3

A₂ 1/2-4" Dark yellowish-brown (10YR 3/4), friable loam with weak, medium and coarse granular structure. Lower boundary indistinct.

S50NJ-7-1-4

A₃ 4-8"
or
B₁ Strong brown (7.5YR 5/6), friable, light loam with weak, medium subangular, blocky structure. Slightly sticky when wet. Contains considerable gritty material. Grades into underlying horizon.

S50NJ-7-1-5

B₂₁ 8-16" Dark brown (7.5YR 4/4), friable loam with considerable gritty material. Moderate, medium subangular, blocky structure. Slightly sticky when wet. Appears to be slightly heavier than the overlying material. Grades into the underlying material.

S50NJ-7-1-6

B₂₂ 16-30" Yellowish-red (5YR 4/6), heavy loam, close to sandy clay loam probably. Rather firm in place, but friable when disturbed. Moderate, medium and coarse subangular, blocky structure; in roadbank nearby structure is well developed, subangular, blocky. This appears to be heaviest horizon in profile. Boundary between this layer and the underlying one is not sharp.

S50NJ-7-1-7

B₃ 30-40"
or
C₁ Yellowish-red (5YR 4/6), highly weathered till of loam or sandy loam texture; friable; slightly firm in place. Small rock fragments and gritty material numerous. Slightly sticky when wet.

S50NJ-7-1-8

C₂ 40-54" Essentially the same as the overlying material except it is probably less highly weathered.

Small angular rock fragments and some gritty material are common throughout profile, as well as some small stone. Stone and stone fragments are mostly trap (basalt or dolomite) with a small amount of sandstone and gneiss. Surface stones are mostly trap.

This profile appears to be distinctly different from the profiles in Connecticut and Massachusetts in profile texture, structure development, and in the degree of weathering in the underlying material.

S50NJ-7-1-1 to 7-1-8 Lab. Nos. 5121 to 5128

Depth Inches	Horizon	M.E./100 Grams Soil						% B. SAT	pH	% O.C.	Size Classes %							
		Ca	Mg	K	Na	H	S+				Clay	III	USDA Silt	VFS	FS	MS	CS	VCS
1/2-0	A ₀	--	--	--	--	--	--	--	4.6	--	--	--	--	--	--	--	--	--
0-1/2	A ₁	1.7	0.3	0.6	0.1	17.8	20.5	13	4.4	5.3	9.5	17.1	33.7	12.0	19.0	10.9	11.2	3.7
1/2-4	A ₂	0.6	0.3	0.4	< 0.1	10.6	11.9	11	4.8	2.17	9.6	16.6	34.9	10.4	18.0	10.7	10.7	5.7
4-8	B ₁	0.3	0.1	0.4	< 0.1	7.4	8.2	10	4.8	0.65	9.7	16.8	34.5	9.1	18.4	11.1	12.0	5.2
8-16	B ₂₁	0.4	0.2	0.3	< 0.1	7.6	8.5	10	4.8	0.28	9.8	16.7	33.9	9.4	18.8	11.2	11.7	5.2
16-30	B ₂₂	2.5	2.2	0.3	0.1	7.3	12.4	41	5.0	0.13	14.2	14.4	26.1	10.7	17.5	10.9	12.8	7.8
30-40	C ₁	4.2	3.3	0.3	0.1	6.2	14.1	56	5.0	0.10	16.9	12.0	24.0	8.3	17.9	11.6	13.7	7.6
40-54	C ₂	7.0	4.4	0.3	0.1	5.2	17.0	69	5.5	0.09	15.4	14.5	28.4	10.1	18.0	10.9	11.9	5.3

